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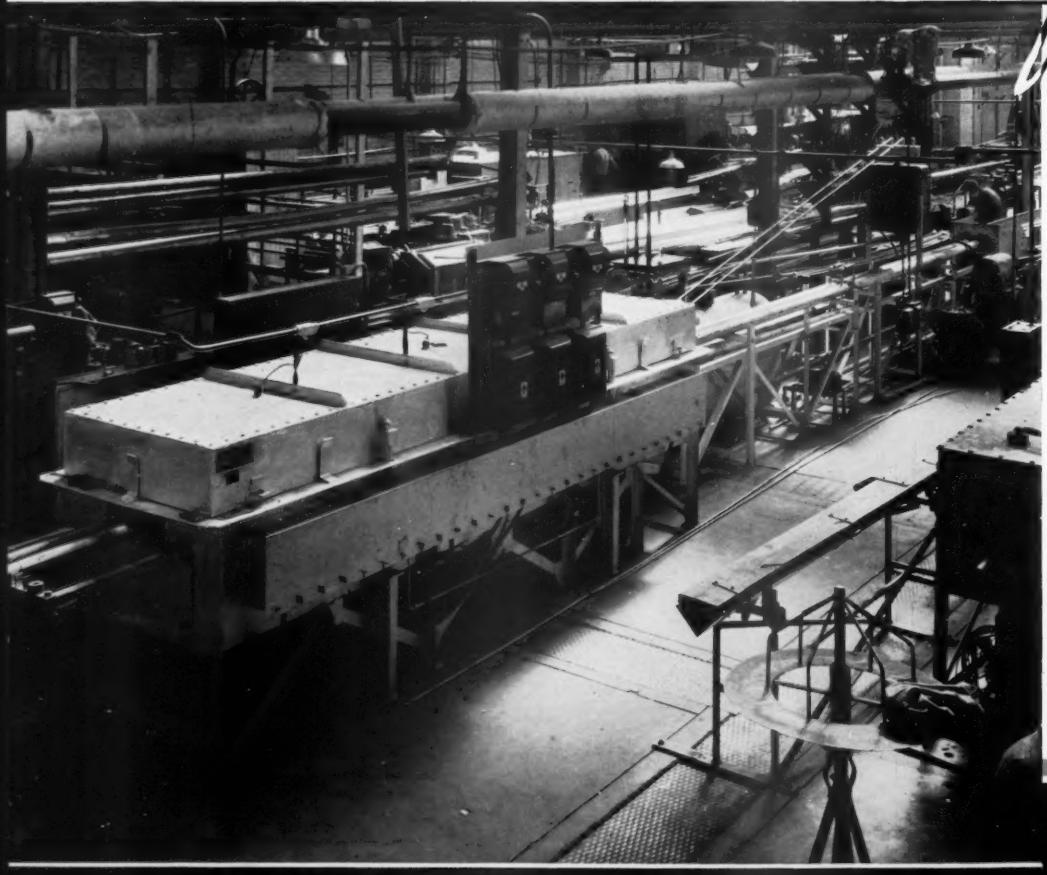

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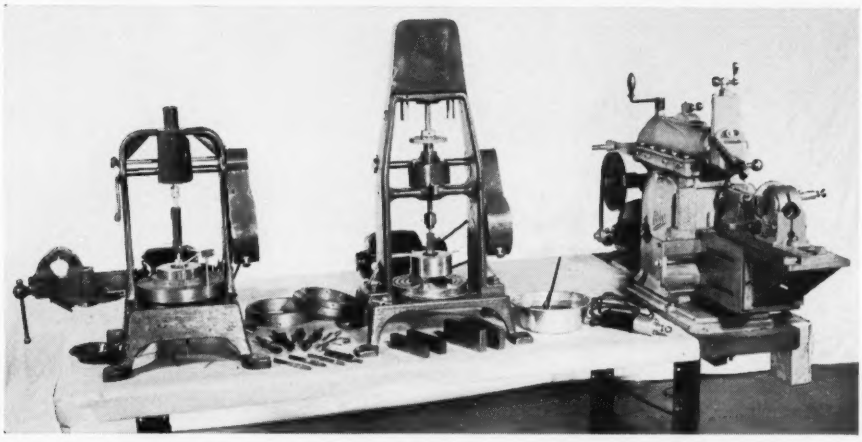

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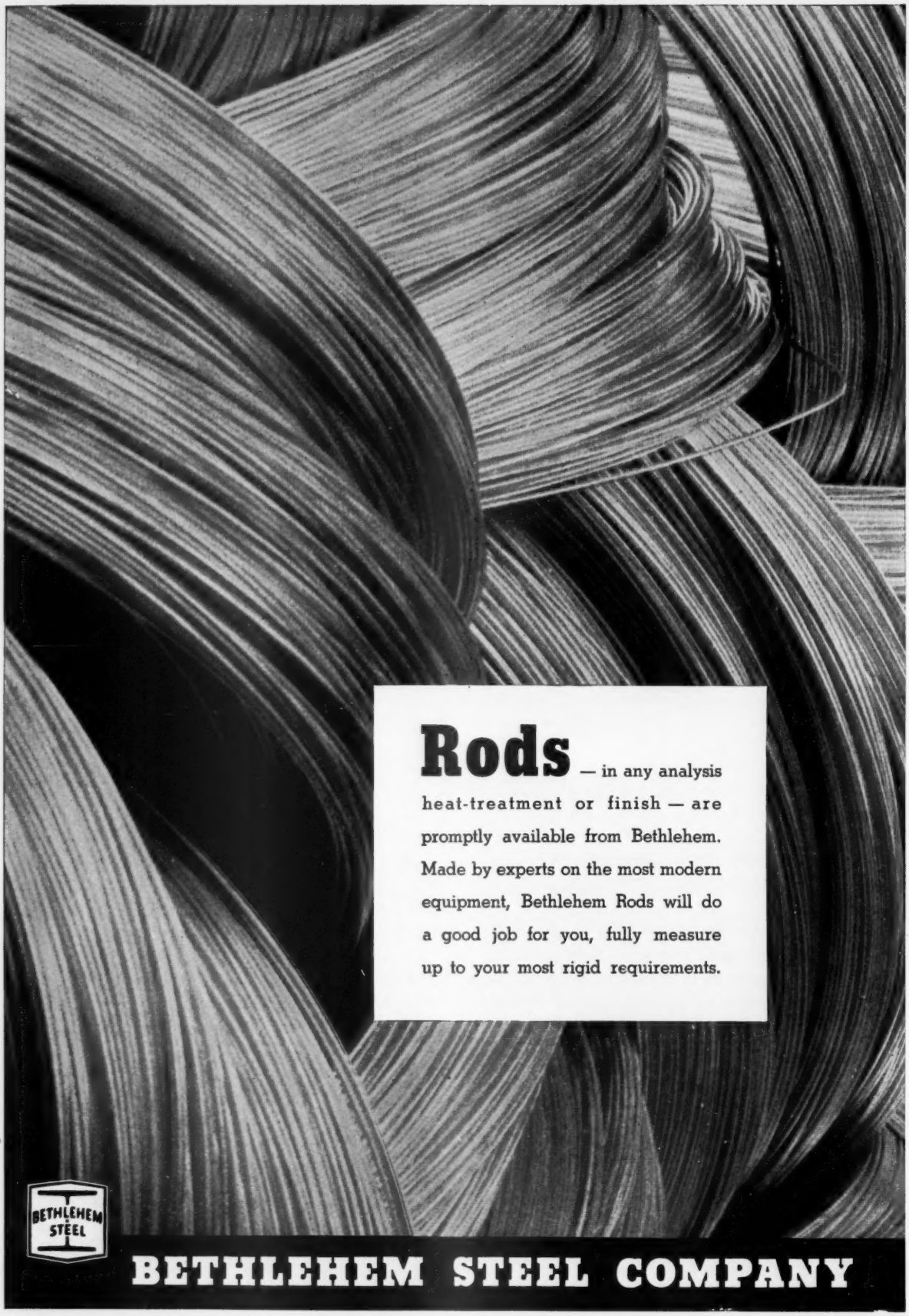
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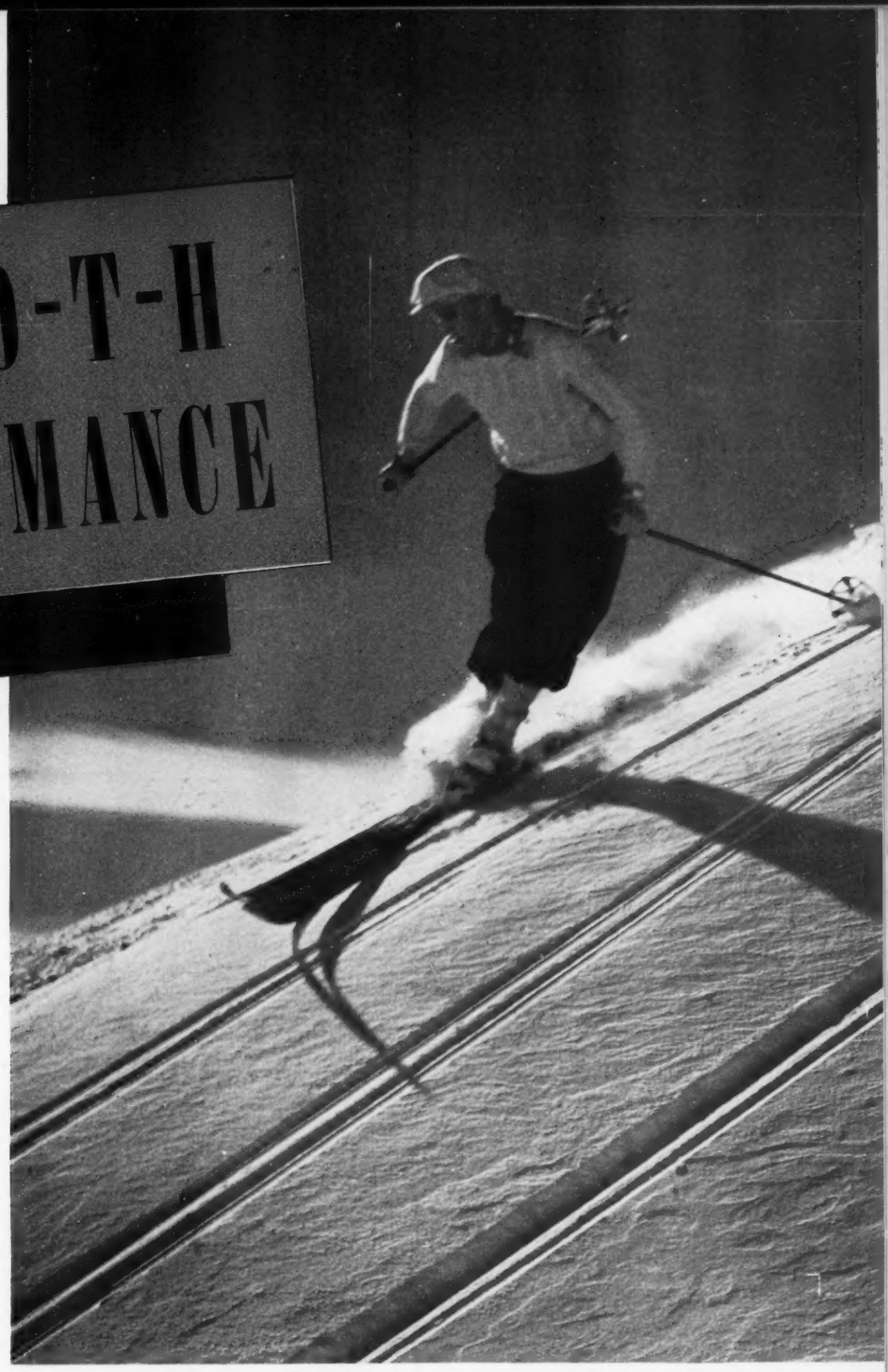

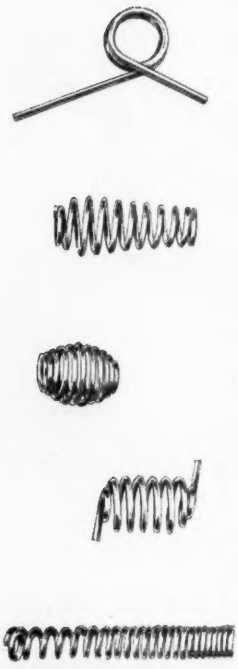

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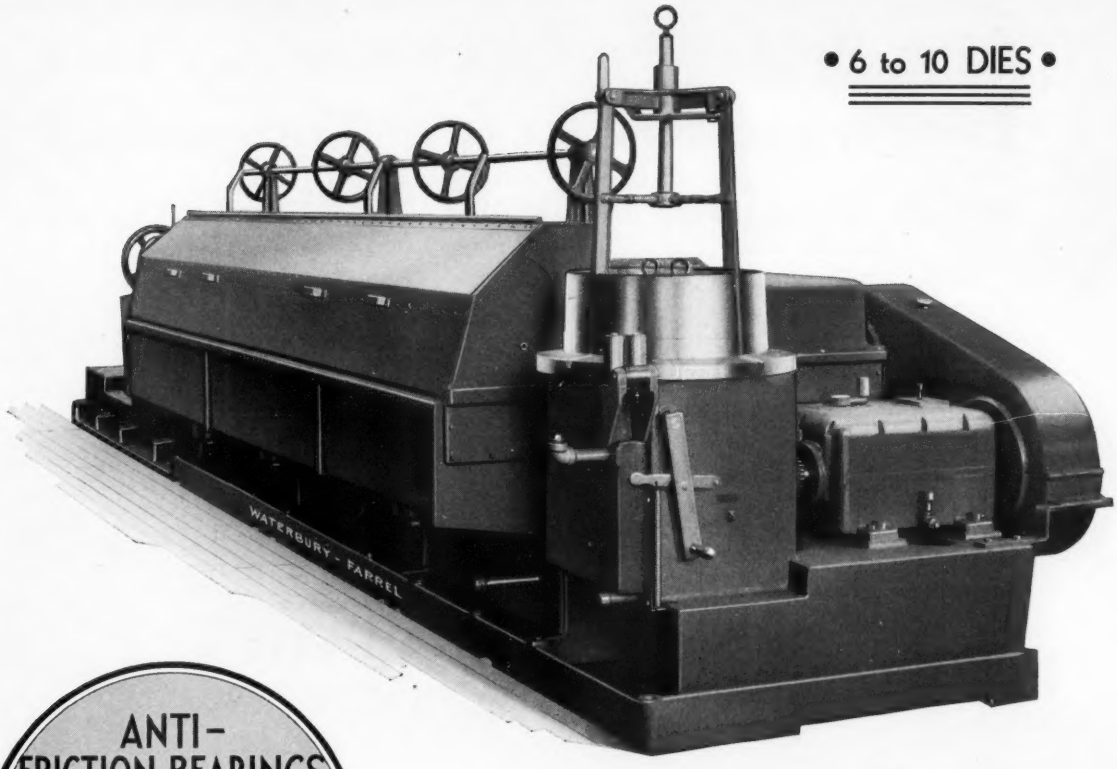

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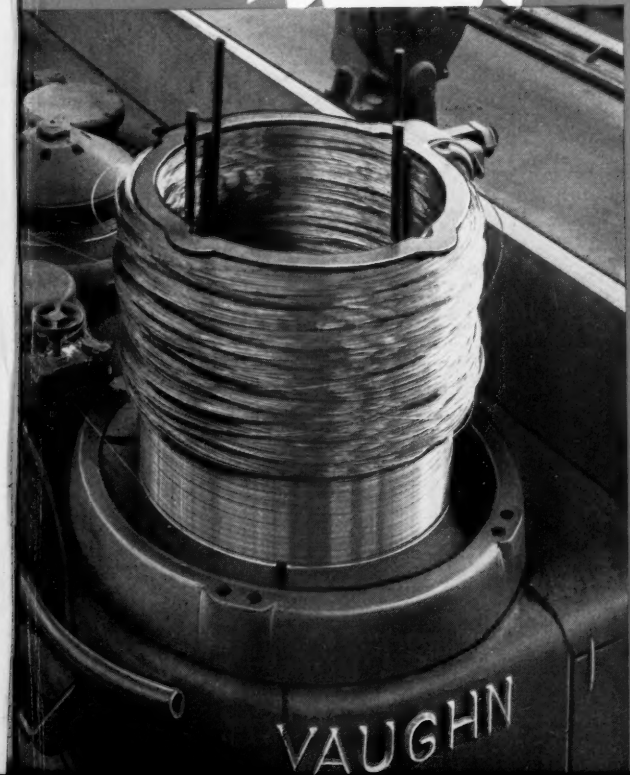

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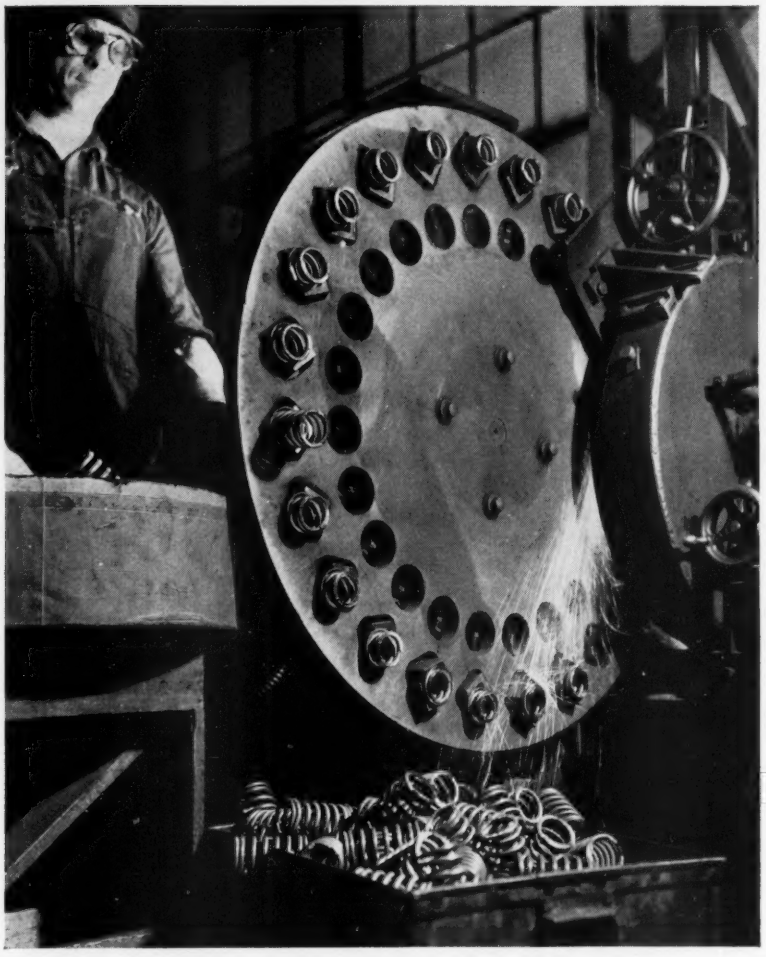

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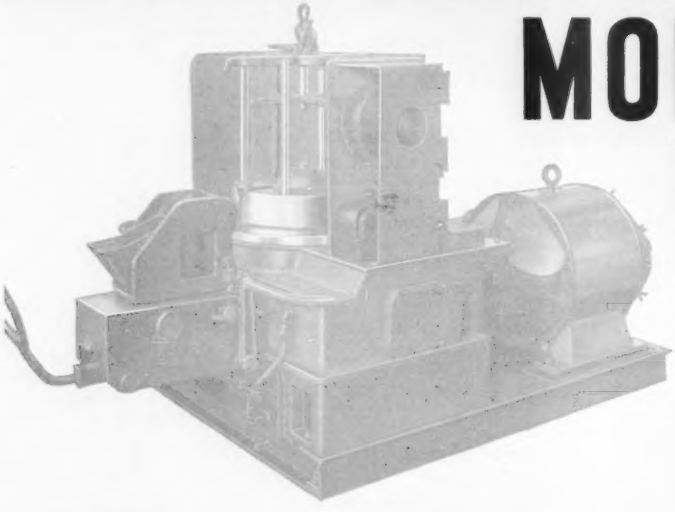

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A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING—ROLLING—EXTRUDING—FORMING—FABRICATING

Vol. 16 FEBRUARY, 1941 No. 2

Designated as

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Contents

Fine Wire Industry ..... By Paul L. Herz 109

Self-Compensating Instrument Springs, By J. W. Rockefeller, Jr. 116

Worcester Wire Works Installs First of New Lee Wilson Furnaces in Wire Industry ..... By J. L. Whitten 120

Design with radiant tubes in the inner cover shows marked increase in production and decrease in fuel consumption in progressive New England plant.

Revised Standard for Tree Wire Promises Wider Popular Use ..... By R. H. Titley and D. S. MacCorkle 122

National Defense Developments 132

The Platinum Metals in 1940 ..... By Chas. Engelhard 134

Outstanding Personalities of the Wire Industry 123

American Iron & Steel Statistics — November, 1940 124

Exports & Imports of Wire 125

A Review of Recent Wire Patents 129

Index to Advertisers 145

Where to Buy 145-146-147-148

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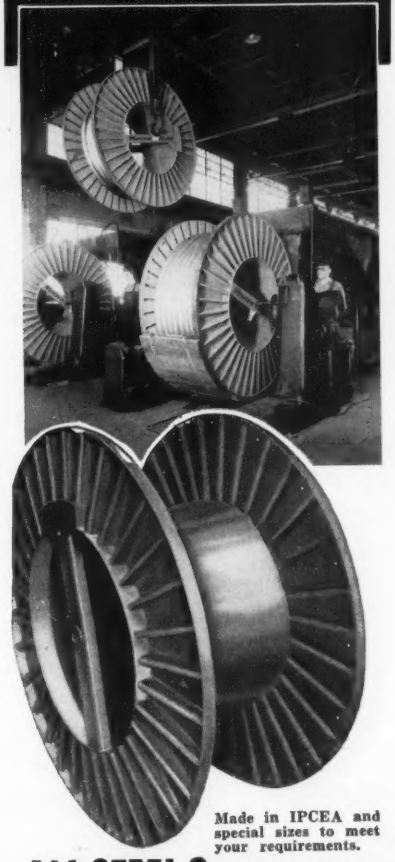

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DRAWING --- ROLLING --- EXTRUDING --- FORMING --- FABRICATING

Vol. 16 FEBRUARY, 1941 No. 2

Fine Wire Industry

By Paul L. Herz,
Technical Advisor and Manager,
Belgian Tool Co., (Malines, Belgium)

THE production of fine wire either ferrous or non-ferrous is assuming great importance now that the war has shut off this country from the supplies formerly imported from Europe. Moreover, many countries are looking to us for the supply of this commodity which they formerly manufactured themselves or purchased abroad. But unfortunately, while this country is equipped to produce practically all varieties of metals and alloys, as well as many excellent types of wire drawing machines, fine wire drawing is so complex a problem that few firms are willing to devote the necessary time and money required to develop this important branch of their industry. This is due

(1) to the lack of the most elementary technology,

(2) to the absence of manufacturers of fine dies.

✦ ✦ ✦

THESE two difficulties must be overcome if the fine wire industry is to develop so that it can take care of home needs and foreign markets available now.

DURING the last few years a definite attempt has been made to place the wire drawing industry on a more scientific basis. Few industries have had to develop with the sole aid of empirical tradition. While considerable progress has been made in the capacity of production, due to the modern high speed machines, this advancement is mostly due to the use of better "wear resisting" dies which permit the increase of drawing speed.

PAUL L. HERZ
Technical Advisor and Manager
Belgian Tool Company (Malines, Belgium)

✦ ✦ ✦

CONTRARY to what has happened in other industries, little progress is due to the labor of scientists, engineers or mathematicians. The reason for this neglect by the theoretician is that the problem is so complex that it cannot be solved by one specialist. It seems to require the simultaneous attention of the physicist, the chemist and the metallurgist, in accord with the production cost manager. No hope of progress can be held forth unless this seemingly hopeless task of unravelling the various problems can be tackled successfully.

✦ ✦ ✦

IN other words, the task of each specialist should be defined so as to have him solve his particular problems and then coordinate the result with that of the others.

Designated as Official Publication by the Wire Association

SURELY further progress can be made if interested specialists will give attention to the solution of the various problems. Let us roughly classify these problems. They come under five different headings, as follows:

1. **Metal**
2. **Lubricant**
3. **Die**
4. **Drawing Machines**
5. **Cost of Production**

✦ ✦ ✦

General Considerations

OBVIOUSLY, the five categories are interdependent. Any change in the condition of one will influence one, or more, or all of the others. So, any change of condition in one of the categories must be taken into account simultaneously with the problems it raises in the others.

✦ ✦ ✦

FOR instance; one may have arrived at an ideal working condition for, let us say, bronze wire, by using the ideal lubricant and the best suited die and the most efficient machine, and thus producing the highest grade wire at the lowest cost. **All working conditions may have to be changed** if it is decided to anneal your wire at a different moment. It may be found that the result is no longer satisfactory and that it requires the changing of the viscosity of the lubricant. Thus the profile of the die and perhaps the speed of drawing of the number of dies may have to be changed.

✦ ✦ ✦

LOOKING at it from another angle: Suppose it is discovered to be essential to alter the chemical composition of the lubricant so as to get a cleaner and more brilliant wire, then in changing the lubricant it may be necessary to alter the profile of the die as well as the speed of drawing, and so on.

✦ ✦ ✦

AGAIN: supposing a market is found for fine hard steel wire with higher contents of, let us say, carbon, than that for which production is geared, then by merely drawing this material in the same manner as the softer wire has been drawn most likely the result will be disastrous. In this connection it must not be overlooked that diamond dies will not stand up and the result will be high die cost, many interruptions and stops, poor wire and deficient production. Unless one has had previous experience, time and money will be wasted for the lack of elementary technology!

✦ ✦ ✦

1. Metal

THE term "metal" of course covers the widest field, but the wire industry at least benefits from all the scientific and theoretical data obtained from the metal world, and a lot is known about structure, temper, quench, annealing and crystallography.

✦ ✦ ✦

*RECENT progress made with investigating apparatus using gamma rays, diffraction of electrons or X-ray, forecast the possibility of obtaining pictures and even moving pictures of the comportment of metal during drawing or annealing process. However, let us consider the subject only from the narrowest angle and insofar as it influences directly the four other problems.

✦ ✦ ✦

WHAT is of interest to us is the following:

a) **hardness of metal**
b) **ductility**
c) **change of coefficient of hardening through drawing**
d) **frequency or interval of annealing and state of surface**
e) **abrasiveness of components**
f) **the nature of surfacial structure**
g) **metal's comportment in face of oxidation and acid action**
h) **melting point and reaction to heat**
i) **coefficient of expansion**
j) **modulus of elasticity**

✦ ✦ ✦

THERE is little likelihood of all, or any, of these physical properties being the object of absolute valuation to be inserted in any equation which may help solve some of our problems, but an intimate knowledge of all physical properties of the metal, as well as its chemical and physical comportment during the drawing process, is necessary to enable the observer to ascribe every phenomenon to its exact cause, whether inner or outer.

✦ ✦ ✦

MUCH more might be said under this heading, but it would complicate rather than simplify matters should we delve deeper into it at this present time.

✦ ✦ ✦

2. Lubricant

FIRST let us define what is expected of a lubricant. **The ideal lubricant should produce an oil film, capable of protecting the wire while it is being drawn through the die and at the same time keep the wear on the die down to a minimum, while permitting high speed drawing with the least effort.**

✦ ✦ ✦

WHAT are the adverse conditions the lubricant has to contend with?

a) **Elevation of temperature which destroys its properties.**
b) **Difficulty of maintaining itself on the wire clean through the passage through the die.**
c) **Oxidation of the wire.**

✦ ✦ ✦

a) Elevation of Temperature Which Destroys its Properties.

THE question of temperature has been an object of my research for many years, for its effect on the rapid wear of dies has been rendered obvious by experience. It has been my contention for many years that the surfacial temperature, that is the temperature reached locally at the point of friction between the die and the wire, was of the highest order and could not be far below the melting point of the metal. Although this seemed preposterous ten years ago, wear on diamond as well as on tungsten carbide made it seem likely to me. Failing to find a practical method for recording the heat generated at the point of friction through thermodynamic measurements I experimented with .008 diamond dies set in brass casing 1 inch in diameter and ¼ of an inch thick. A high carbon steel wire .009 was used and drawn at a speed of 12 to 15 feet per second. Tests were made with

***Referring to the experiments of Professor G. I. Finch (London) and associates, on surface of metals and crystal with apparatus of diffraction of electrons, and experiments of Professor Holmes (Mons, Belgium) using X-ray pictures of structure up to 0.75 mm. depth.**

various lubricants at various speeds.

✦ ✦ ✦

WITHIN a short time the brass casing turned to a color which could have been caused only by a temperature of between 250 and 300 degrees centigrade. Considering the small surface of friction and the metallic mass involved and other factors of dispersion of heat, approximation of probable temperature at source, even allowing for important error in approximation, showed that the surfacial temperature at point of friction could not be below 1000 degrees centigrade.

✦ ✦ ✦

WHAT amounted almost to guessing became a certainty as a result of the remarkable work of **Professor G. I. Finch, Member of the Royal Society of Physics,** and his associates. **Professor Finch** in a series of lectures as title holder of the **Francqui Chair** at the **University of Brussels,** propounded his theory on polishing (year 1936-1937). The English savant and his collaborators proved the theory with his apparatus of diffraction of electrons which clearly showed the status of a metal surface when rubbed to obtain polish.

✦ ✦ ✦

BRIGHT polish, obtained on a metal or crystal, is due to the presence of an amorphous coat of atoms which fill the anfractuosities of the crystalline surface. It is this amorphous coating—named Bailby coating—which makes up the high polish. The high polish is caused by the rubbing, and the explanation is that the heat thus generated loosens the atoms from the peaks of the crystalline body and causes them to flow between the asperities of the surface. This can only happen if a surfacial temperature close to melting point is attained. Rubbing a metallic or crystalline surface is identical to the friction produced by wire passing through a die.

✦ ✦ ✦

IN other words, when a metallic or crystalline surface is rubbed until highly polished, a surfacial temperature reaching the melting point of the metal or crystal is obtained. This fact obviously must be taken into account when searching for a suitable lubricant. (We will see later that it also has to be reckoned with when studying (1) metal and (3) dies).

✦ ✦ ✦

IT is essential that a lubricant be chosen, the properties of which will hold even at high temperature.

✦ ✦ ✦

b) Difficulty of Maintaining Lubricant on the Wire Clean Through the Passage Through The Die.

THE failure of lubricant to maintain a protective film on the wire has fatal effects on both diamond or tungsten carbide dies. It accounts in steel wire drawing for the many diamond dies which show torn outlets caused by a gripping of the wire. Diamond dies are also prematurely cracked through the expansion of the wire subjected to great heat. This, too, accounts for the outlet wearing square or oval.

✦ ✦ ✦

WHEN speaking of a lubricant one usually has in mind a liquid, often an emulsion containing mostly water and a certain quantity of Marseille soap and rape seed oil. Sometimes acid is added. But it must not be overlooked that in certain cases plain water **answers the purpose.** Dry soap has been successfully used in fine wire drawing, but good results were obtained with very hard steel wire only when speed of drawing was reduced and profile of die calculated to permit the passage of the soap through the die. Great saving in die cost ensued.

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ADDITIONAL lubrication such as coppering steel wire or the use of lead or graphite in some form or other is also of interest.

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I HAVE known very successful use of coppering in drawing platinum wire. The copper coating is a great saver of finishing dies and can be removed easily from the finished platinum wire.

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THE working out of the lubrication problem is a chemist's job that can be summed up like this: To find a lubricant with a tenacious molecule that will not be destroyed by great heat and one which will also keep its protecting film on the wire or on the die.

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THE various angles of the die should be so designed as to permit the film to subsist even at the points of highest pressure. The viscosity of the liquid must be such as to avoid "packing" at the inlet of the die. Diamond has a well known affinity for fats and is thus easier to protect than any other die material.

✦ ✦ ✦

c) Oxidation of the Wire.

LUBRICANT should not affect the brilliance of the wire or cause its early oxidation when finished.

✦ ✦ ✦

3. Die

UNDOUBTEDLY the die plays the most important part in fine wire drawing. Not alone on account of its immediate influence on the quality of the wire, but also because of its relation to cost. There is no doubt but that if wear resistance is increased so as to allow higher speed of drawing, production can be increased. Furthermore, if a die can be allowed to work for a long period of time without being removed for repair the loss of time required for rethreading the die can be greatly reduced. In addition, it is essential to reduce the percentage of wasted material caused by breakage.

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THEN, lastly, the die cost plays an important role in the general cost of production, especially when the wire drawn is fine, hard or tough, or requirements of tolerance in size and roundness are high.

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ONE very important item in discussing the efficiency of a die is the influence of the temperature on the wear at the point of friction. I have already shown that temperature at the point of friction reaches the point of fusion of the metal. In the case of metals

where this melting point is above 1000 degrees centigrade we arrive at a temperature which is conducive to the acceleration of the disintegration of either carbon molecules of the diamond or tungsten carbide molecules.

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NO amount of outside cooling can prevent this temperature being reached at the point of friction. Even should we be able to maintain the temperature of the lubricant far below freezing point, this would have no effect on the surfacial temperature at the point of friction. Furthermore, it is an accepted fact that it is an advantage to draw in a bath of higher temperature, almost boiling point, for the effect it has on the fluidity of the lubricant as well as on the wire.

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YET, if temperature at the point of friction can be kept below the critical point there is no doubt but that wear can be reduced. Let us examine what the various possibilities are of reducing temperature.

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Lowering of Temperature

a) Reduction of drawing speed.

THE heat generated in the wire is affected by reduction, friction and speed, speed being the most important of the three factors and the one that can most easily be dealt with. It is a simple matter to reduce the speed of drawing to a point where the saving on die wear and die breakage compensate the additional cost of smaller production. An exact balance of the two is an advantage in itself in favor of the slowing down of the speed, for one is likely to obtain a better wire.

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b) Reduction of wire size.

THIS is also a matter of calculation. When the percentage of reduction is too high the die suffers at the inlet which is often torn away, causing total breakage. The question of rational reduction should be made the object of separate experimentation for each metal.

c) Friction.

THIS should be considered in the light of the profile of the die. It is a very intricate matter to discover the proper angle to be given to the die so as to keep friction and thus, wear, down to a minimum. The underlying principle governing the solution to this problem should be the fact that the oil film of the lubricant must remain as a protection between the die wall and the wire clean through the drawing. Extremely interesting work is being done with what is called reactive wire drawing. This is a comparatively new field but it deserves fullest attention as it may well be a factor in the lowering of die wear.

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IN working out the various problems relative to the die there are certain considerations which we have to bear in mind. When drawing fine wire there seems to be but little doubt that tungsten carbide should be eliminated in favor of diamond, especially in the finer sizes and for harder types of metal. When using diamond dies in a rational manner it is a fact that diamond is superior to the carbide. When the right die is used and properly handled results obtained with diamond dies are better than those obtained with carbides.

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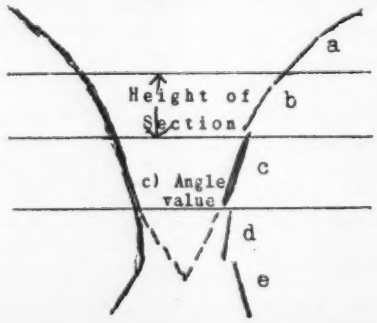
Some Facts About Diamond Dies

CONTRARY to general belief, it can be accepted as a fact that there is no variation in the hardness of diamonds, hardness being understood in this case as resistance to wear in wire drawing. The variations which occur in the yield of diamond dies and which are often ascribed to differences in hardness are due to other causes which can be eliminated. I have advocated (see some of my patents years 1930-1931), the drilling of the stone from point to point in a perfect octahedronal crystal along the line of the 3A4 axis. This has proved successful and eliminated premature breakage due to the splitting of the crystal when same is drilled in any other direction which always favors one line of cleavage. Ten years' practical experience has confirmed this theory.



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AN important factor is the avoidance of all crystals which show air holes, carbon spots and other inclusions or cracks, however minute. These imperfections are always the starting point of a break through the closest cleavage plane.

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OF vital importance is the design of the profile of the die. This profile is usually divided into five sections.

a) Inlet or radius
b) Entering angle
c) Angle of reduction, or approach angle
d) Bearing
e) Outlet, or back relief angle

✦ ✦ ✦

BOTH the angle value and the total height of each section will vary according to the metal drawn and must be coordinated with speed, reduction and lubricant (see sketch).

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a) Inlet, or radius.

THE angle required for the inlet should merely help the inflow of the lubricant, and should not be so narrow as to permit the gathering of fats or wire scrappings. This angle is in the form of a cup, or bell, and was primarily intended to hold the abrasive powder used in the drilling of the die. Where this inlet joins with the entering angle, it should be rounded off.

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b) Entering angle.

THIS angle can be very open and not very high. It should serve to guide the wire straight into the angle of reduction. Rounding off into the angle of reduction and polish are required.

c) Angle of reduction, or approach angle.

THE value of this angle as well as its height are most important factors. These should be so calculated as to spread the work of reduction over widest area in order to diminish the stress at one given point and thus reduce the generation of heat. On the other hand, friction should be considered as this surface is increased. **The angle should be so designed as not to interfere with the oil film.** The angle of reduction should be rounded off into the bearing so as to avoid a "shoulder", and high polish is required.

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d) Bearing.

THE height of the bearing should vary according to the physical properties of the metal. In order to diminish the rapid loss of gauge of the die bearing should in principle be as long as the tensile strength of the wire will permit. For instance, soft copper wire, as everyone knows, will not stand a long bearing. If the bearing is too long the wire will either break or come out irregular in size. In the case of hard steel wire going through a very long bearing, the metal will expand inside of the die and may crack the crystal. Sometimes, stress or friction being too great, the temperature will rise and dry up the lubricant. This will cause the ripping out of the outlet.

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THE combination of the right angle of reduction and proper height of bearing is the key to the great riddle of wear. This is what should be studied with particular care, and I think that it belongs to the realm of both the mathematician and the physicist. The solution, of course, will be different for every different metal, and this will bring about a corresponding variation in lubrication, speed of drawing and percentage of reduction.

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e) Outlet, or back relief angle.

IN judging how the outlet should be shaped one should be guided by the desire to avoid the tearing which occurs when the "shoulder" between the bearing and the outlet is too sharp. It has often been suggested that the outlet should start with a slight taper which will act as a take-up on the wear of the bearing. Users of dies often check same in this respect by pulling the wire back. It is needless to insist upon the necessity of giving a very high polish to the entire profile.

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WEAR is also a function of polish. No matter how high the polish, one will always find rings and waves by examination through a microscope with sufficient enlarging capacity. But the depth of the waves should be kept down to the smallest pitch and rings can be practically eliminated by expert handling of efficient powder. High polish, of course, means additional cost, but cost should be disregarded up to the point where it stops being commercial. The proper technique for obtaining high polish is a problem in itself and is closely linked to the manufacture of fine uniform grain powders. A lengthy chapter could be written on the subject.

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4. Drawing Machines

THERE are many good drawing machines on the market, both of national and foreign make. I regret, however, to warn wire drawers against a tendency toward exaggeration found in the claims for high speed production made by the makers of some machines. Many machine makers work on the theory that the dies will stand anything and that the only problem to be solved for reaching greater output is that of gearing up the mechanical apparatus. This is a profound error. The speed of drawing has practical limitations beyond which it does not pay to go.

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THE limit of speed is of course different for each and every metal drawn. In setting a limit for speed one should bear in mind the rising temperature resulting from higher speed and its consequences.

5. Cost of Production

COST of production is a direct function of the output. It can readily be seen that if the increase in production is obtained by speeding up the run of the machines, the time comes when the benefits are more than offset by costly drawbacks. Let us examine the various points which ought to be considered.

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a) Wear and damage done to dies.

THE faster the draft, the quicker the dies wear and the higher the chance of a breakage. Obviously, the time comes when wear and tear are no longer compensated by additional production. In determining the limit of speed one should take into consideration the cost of the die.

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b) Loss of time through stoppage of work.

EVERY time the wire breaks either through high speed or stress a great amount of time is wasted until the machine is ready for work again. Pointing the wire and re-threading all the dies represent a loss of time.

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c) Waste of material.

IT goes without saying that every time the machine is stopped, waste of material ensues. In most cases the wire drawn is of no value unless drawn all in one, unbroken length.

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d) Quality of wire.

THE race for high output is often effected at the expense of the quality of the wire. When drawing above a certain speed the wire comes out, out of round, or no longer within the tolerance of size.

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I DON'T see that it is possible to establish a hard and fast rule to apply in every case and under all circumstances. The matter of establishing what is an economical and rational speed should be determined in every particular case by the factory manager. Most likely, it can be arrived at by practical experience. Tests running over a certain length of time can be made at top speed so as to gauge the damage done and its cost.

Speed should be gradually slowed down until rational average is reached. Generally speaking, I have found that speed of drawing is usually exaggerated and goes beyond the limit of economical drawing.

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e) Die cost.

THE important outlay is unquestionably the purchase of the dies. A die cannot be considered as an investment like, for instance, drawing machines where depreciation is spread over a long period of years. Dies are tools and their wear is rapid. Especially when drawing hard wire and/or fine wire, the outlay for dies represents the most important item in the cost of production. It goes without saying that the **total yield** of the die has a direct influence on the cost of production. Buying, handling and re-cutting dies are difficult jobs and require experience and knowledge.

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EXPERIENCE has shown that it is a great saving to carry an adequate stock of dies. In many shops dies are subjected to heavy re-cutting, rather than purchase new dies. This is sheer waste of expense and capital for such dies should be kept for future use, or could eventually be re-cut slightly to fit in an intermediate series. It must be borne in mind that when a die is uselessly re-cut to much higher size, it is at a cost of a great expenditure of labor and powder. It should be also remembered that the die will not be as efficient at the re-cut size as it would have been if merely re-cut to the closest roundness. The keeping of a large stock of dies represents nothing but the interest on the outlay, for dies do not deteriorate in the stockroom.

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AMONG bad habits which seem general, is the one of using dies for a purpose for which they were not manufactured. For instance, many concerns prefer using the stock on hand rather than buying new dies suited to the new job on hand. This is not conducive to economy.

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INITIAL die cost can be kept down to a minimum by simple calculation. Diamond dies go up in price as the size of the hole increases, except in the case of the 000's where it is the contrary. In many cases it is more advantageous to purchase nothing but the smaller size and depend for a supply of larger holes upon the re-cutting of dies already used for finishing size. It may happen that in re-cutting these dies you will find that a number of them will not stand the increase in size all the way up to the starting size, but it may be more economical to proceed that way than to purchase the more expensive dies for the larger holes. This is especially true in the case of hard wire.

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f) Saving on die expenditure.

PROPER care in the recutting is undoubtedly the biggest factor of economy. Out of 200 firms taken at random throughout the world, and which I have frequently visited, those who get a sufficient yield out of their dies are few. This is due to the generally prevailing haphazard manner in which the re-cutting problem is handled. It is of course a paying proposition for small users to send their dies to be recut to reliable die makers. But such is not the case where the outlay for dies reaches five figures annually. Here, an efficient re-polishing outfit becomes an absolute necessity. Skilled labor and adequate machinery are needed for this work. It should also be pointed out that adequate re-polishing powders are essential. Unless the right grain sized powder is used one can be certain that the dies are being damaged to the extent of 70 percent of their productivity. Here is a suggestion for efficient die care.

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One should set a limit of wear after which the die should be removed from the machine, and periodical checking of the size of the wire should reveal if this tolerance has been reached.

All dies so removed should be thrown into a bucket containing a grease-cutting agent such as gasoline, for instance, and allowed to soak for about twenty-four hours.

Then comes the sizing to see whether the die is worn round or not. Dies that are un-round should be set aside for re-cutting.

The dies should then be cleaned and the bearing cleared as is usually done with wooden sticks so as to allow close examination with the loupe.

This examination should reveal whether polish is still good enough and whether there is no injury to the inlet, bearing or outlet.

Dies which show no damage and which have retained their high polish and their roundness can be returned to stock for use when such size is needed.

Dies which show no other sign of wear, but loss of polish should be re-cut with very fine powder until high polish is restored, without altering the size.

Dies which are un-round should be re-cut until roundness and polish are obtained.

And finally, dies which are damaged should be re-cut until all traces of injury have been removed.

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Powders

I CANNOT lay enough stress upon the importance of using adequate powders. In most cases firms use broken dies or/and crushing board for manufacturing their powders. This is all right, provided they know the technique of powder making. This operation is very delicate and requires a keen knowledge of the subject.

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POWDERS are usually divided into seven numbers, each of which serves a definite purpose. If these powders are not exactly what they should be it is a safe guess that the re-polishing merely spoils the die.

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IT is surprising how much use one can get out of a die when the right care is taken. The yield per die varies from one to ten, according to the kind of care it is given. I will cite but one example out of hundreds to illustrate the point. I know a shop where .007 hard steel wire is drawn and where dies reach .018 after being re-polished an average of eight to ten times, yielding at each re-polished size a full poundage of wire. In some other shops the average of re-cuttings will not reach five, and it is safe to say that the yield at each intermediate size will not compare with that obtained in the first case.

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I MUST not omit mentioning that each die should have its record of production. It is a good check for the purchasing agent and the shop manager.

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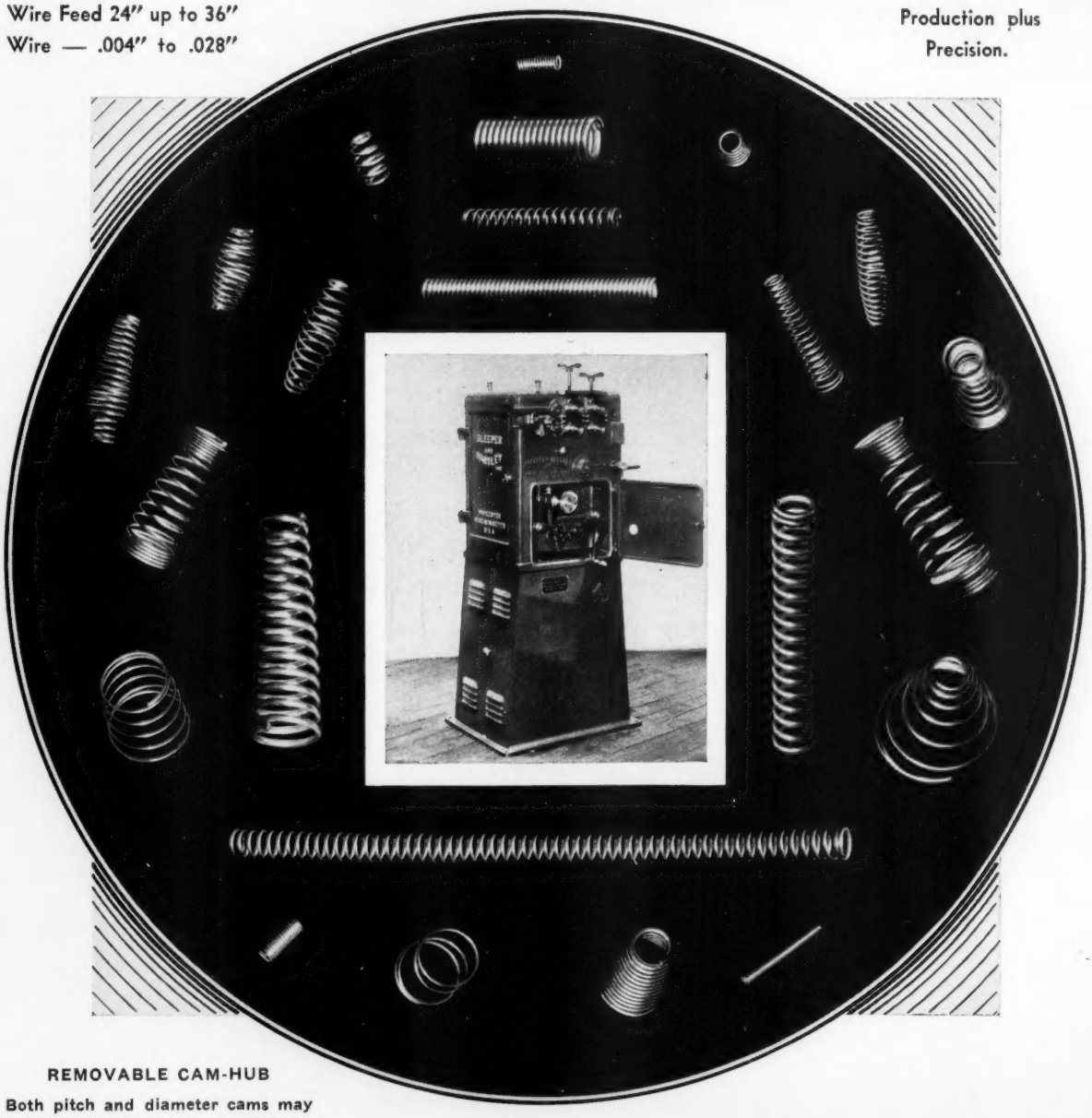

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Self-Compensating Instrument Springs

By J. W. Rockefeller, Jr.,
Consulting Engineer,
New York, N. Y.

THE advancement in design and manufacture of instrument springs has parallelled progress in the construction of the instruments themselves. Today's self-compensating scale spring bears little more resemblance to its progenitor than today's streamlined computing scale resembles the first spring balance that came into being directly as the result of the discoveries of **Robert Hooke.** From a tempered wire spring used in connection with a hand calibrated dial, scale springs progressed through various stages of annealed wire, case hardened and alloy wires, to our present self-compensating springs. The history of the development of scale springs would be one of methods of constantly increasing precision. From earlier cut and try methods which might produce a spring of almost any length by the time it was calibrated to suit the job, tolerances on wire diameter tightened up. The outside diameter of the spring in the process of manufacture was carefully adjusted to any variations in the diameter of the wire so as to produce springs which were of uniform length.

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INSTRUMENT springs generally and scale springs in particular require special properties. For one thing, these springs should possess a reasonably straight load deflection diagram (that is, the rate must be uniform). In the case of platform scales, several factors including the passing of the nose iron of the scale through an arc during the weighing, makes necessary a final adjustment in the static balancing of the indicating drum. The ideal spring to eliminate the necessity for this, would be one having a slightly concave line load deflection characteristic which would complement the nose iron effect. Since otherwise, a final adjustment is required in any event, the accuracy of load deflection diagram beyond reasonable tolerances is neither necessary nor desirable.

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Hysteresis

THE failure of the unloading curve of a spring to coincide with the loading curve is in most commercial applications of little importance. In the case of scale springs, however, the freedom from excessive hysteresis is essential. Scale springs are made with a hysteresis of less than .1%. While this may seem to insure a fair degree of accuracy, in cases of well made computing scales, it is necessary to hold the hysteresis to a smaller figure even than this.

J. W. ROCKEFELLER, JR.
Consulting Engineer

Graduated from Massachusetts Institute of Technology 1921. 1921-1928, John Chatillon and Sons, New York, N. Y., from which resigned as Works Manager to enter consulting field. Has been engaged in installation of spring plants and design and production of wire springs for firms in spring, spring balance, and automotive fields. Charts for calculation of helical springs, translated into Kilo-Cm basis and adopted by Italian Engineering Standards Committee, 1926. Secretary of Spring Research Committee of American Society of Mechanical Engineers for five years and during that time representative of American Society for Steel Treating on that committee.

Physical Dimensions

AS a general rule, the physical dimensions of the springs are of little importance in scale application providing, of course, they permit the installation and operating of the springs in the scale with sufficient clearance all around. Once these dimensions are determined, however, it is desirable for the sake of uniformity and ease of assembly to hold the length as nearly uniform between the different shipments of springs as possible.

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Temperature Effect

THE effect of temperature on springs is decidedly important from the point of view of the scale manufacturer. Temperature affects springs in two ways, first it will change the physical dimensions of the spring. In the case of most metals, there will be an expansion with a rise in temperature and a contraction with a decrease in temperature. This change of dimensions under varying temperature in springs is desirable in scale application to a certain degree. In the case of steel springs, in most scales, the spring itself expands and contracts to a greater degree than the other parts of the scale (i. e. the casting which may form the scale head, etc.) This difference in expansion and contraction between the spring and other parts of the scale produces an error even when the spring is under no deflection under no load conditions.

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ANOTHER manner in which temperature affects springs and one which is particularly important in scale application is the effect upon stiffness of the metal of which the spring is made. In the case of most metals, a rise in temp-

erature is accompanied by increased flexibility and a lowering temperature by increased stiffness. This fact, together with the effect of temperature on the physical dimensions of the spring have for many years constituted the chief objection to the use of springs in scales, particularly where such scales operated out-of-doors and were subject to extreme changes in temperature. This reaction of springs to temperature changes was responsible for the development of many ingenious devices in the form of thermostats to counteract these tendencies. The perfection of a thermally self-compensating spring which would eliminate the necessity for these devices (the zero and capacity thermostats) became the goal of manufacturers of springs for scale application.

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IN calculating the effect of spring errors on the accuracy of the scale, it is well to remember that most platform scales, particularly computing scales, are so manufactured that a fairly large tare is placed upon the springs even before the application of any live load. Let us consider for example, the case of a 30 lb. scale in which the tare load on the springs is equivalent approximately to the live load, a condition not at all infrequent in scale manufacture. An accuracy of .1% of the entire range of the spring would be equivalent to .2% over the useful weighing range of the scale. A .2% error in a 30 lb. scale would be equivalent to approximately one ounce which is in excess of anything acceptable to computing scale manufacturers. An error of ±¼ ounce is about the greatest permissable limit and this, of course, means that in the spring itself, the error must be held within .025%.

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EARLY in the century, the metal, **Elinvar,** was produced by **Guillaume** in France. This metal containing approximately 36% nickel and 12% chromium when perfectly manufactured, is practically unaffected in its elastic modulus by temperature changes.

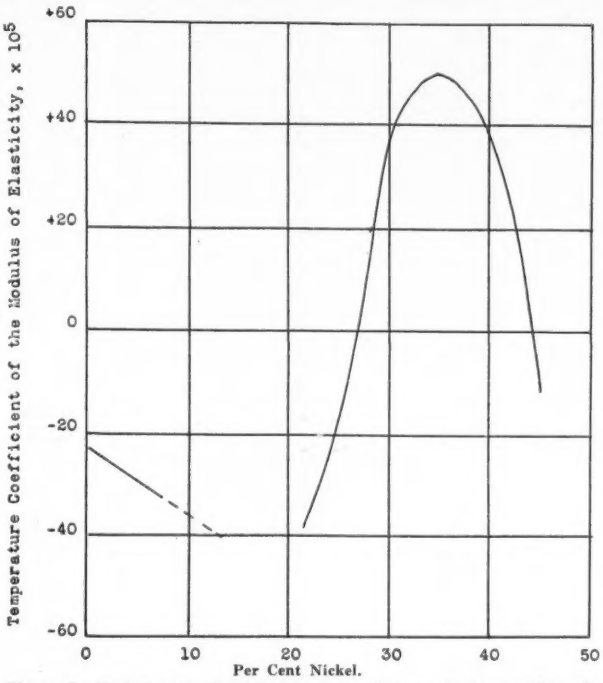

Figure I. Variation in the temperature coefficient of the modulus of elasticity with nickel content. (Guillaume and Keulegan and Houseman.)

Elinvar wire was imported into this country for the manufacture of scale springs in 1922 but due to its low elastic limit had a limited application. Several investigators set about introducing other elements into the composition of Guillaume to produce an Elinvar type metal the elastic limit of which would be considerably higher and which would therefore be rendered more useful in scale application. Some of the elements used in these developments were Beryllium, Aluminum and Titanium. These alloys of the Elinvar type proved a decided advance in scale spring manufacture since they corrected to a large measure the tendency of the spring to change its stiffness with temperature variations. They would not, of course, as a general thing help the matter of zero error or permit the elimination of zero thermostats in scales.

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THE effect of nickel content in high nickel alloys upon the temperature coefficient of elastic modulus is shown in Figure 1. It will be seen that the line crosses the zero axis at a nickel content of approximately 27% and again at approximately 44%. An examination of the chart will give an indication of the manner in which a slight variation in chemical analysis affects the thermal properties of these Elinvar-type materials. An examination of Table 1 will further emphasize the difficulty of holding a chemical analysis of these Elinvar alloys within close enough limits to produce a perfect thermal elastic coefficient. Between al-

TABLE I

Variation of Thermo-elastic Coefficient in Titanium Elinvar Alloys (Pilling and Talbot)

	Analysis							Effective Analysis		Mean Thermo-elastic Coefficient	Modulus of Rigidity (Shear) Millions
								Non-Carbidic	Effective		
No.	Ni	Ti	C	Cr	Mn	Si	Mo	Ti	Ti	0-100° F.	Psi
73	39.55	2.91	0.07	7.5*	0.60*	0.70*	0.45*	2.70	33.6	—70 × 10—6	10.4
74	40.93	2.94	0.05	7.5*	0.60*	0.70*	0.45*	2.74	34.3	—80	10.3
75	41.14	2.68	0.06	7.55	0.63	0.71	0.44	2.44	35.3	—80	10.3
76	41.79	2.75	0.07	7.5*	0.60*	0.70*	0.45*	2.54	35.7	—60	...
77	43.07	2.80	0.06	7.48	0.65	0.67	0.45	2.56	37.0	—55	10.0
78	44.59	2.65	0.06	7.5*	0.60*	0.70*	0.45*	2.41	38.8	—70	9.8
79	46.55	2.91	0.06	7.5*	0.60*	0.70*	0.45*	2.67	40.1	—80	9.9
80	42.84	2.67	0.05	...	0.60*	0.55*	0.45*	2.47	36.8	+180	8.6
81	41.22	2.47	0.05	2.48	0.59	0.54	0.45	2.27	35.7	+80	9.4
82	43.12	2.41	0.07	4.12	0.60*	0.55*	0.47	2.20	37.8	+30	9.6
83	42.36	2.42	0.06	5.00	0.56	0.56	...	2.18	37.1	+15	9.9
84	35.57	...	0.06	7.44	0.60	0.61	0.43	...	...	....	9.4

*Estimated.

loy #77 and #80, for example, the difference in nickel content is only .23% and titanium .13%. The thermal elastic coefficient, however, in the case of alloy #77 is -55 x 10^{-6} while in the case of alloy #80, the thermal elastic coefficient is +180 x 10^{-6}. When it is realized that for satisfactory application, this thermal elastic coefficient should be kept within a tolerance of ± 5 x 10^{-6} from the ideal, the difficulty of controlling the chemical content of these alloys within limits which will result in satisfactory scale spring material will be appreciated. When further consideration is given to the fact that in addition to obtaining the desirable thermal coefficient of modulus, other aims in the production of this material are the attaining of a minimum hysteresis value, the complexity and the difficulty of the problem becomes apparent.

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The Bimetallic Self-Compensating Scale Spring*

A MORE recent development in the field of self-compensating scale springs has as its aim the elimination of the objections to the monometallic scale spring of the Elinvar type. In the manufacture of this spring, an overcorrecting spring material which has good hysteresis properties and preferably a thermal coefficient of expansion of approximately zero, is produced first of all. This material is so manufactured as to give the optimum properties of hysteresis regardless of the thermal coefficient of modulus which will result. When produced in wire form, its thermal elastic coefficient is accurately determined by coiling into a helical spring section. A spring section of undercorrecting material such as steel, Beryllium Copper, etc, is then manufactured and combined with the spring section of the overcorrecting material in such proportions as to produce the ideal thermal coefficient in the combination. The ease with which the thermal elastic properties of this type of spring may be controlled are readily apparent and are in no way dependent upon the close control of the alloy in the process of founding, drawing, cold working, heat treating, etc.

*Patents Pending

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IN addition to correcting the capacity error ordinarily found in the steel spring scale, thus rendering unnecessary the capacity thermostat, the bimetallic self-compensating scale spring can be made in many instances in such a manner as to eliminate the necessity for a zero thermostat. Once the thermal elastic properties of each of the materials to be used in the manufacture of the springs is known, all that is necessary, in order to obtain the desired thermal coefficient of elasticity of the combination, is the correct ratio of deflection between its parts. If, for example, one part of the spring is made of a 36% nickel steel having a thermal coefficient of modulus of 525 x 10^{-6} and the other part is made of steel having a thermal coefficient of modulus of approximately -175 x 10^{-6}, the deflection resulting in the 36% nickel steel section of the spring under a given load must be 1/3 that which will be produced in the steel section under this load. It is possible to bring this condition about by using a wide variety of steel sections and of 36% nickel-steel sections. Either section, for example, may be short in coil length and wide in coil diameter or long in coil length and narrow in coil diameter. Since the thermal coefficient of expansion of the 36% nickel-steel is approximately zero and that of the steel usually well in excess of the other component parts of the scale, the coil length of each may be so selected as to offset exactly the expansion in other scale parts. In this manner, the zero error in the scale is eliminated as is the necessity for any thermostat to counteract it.

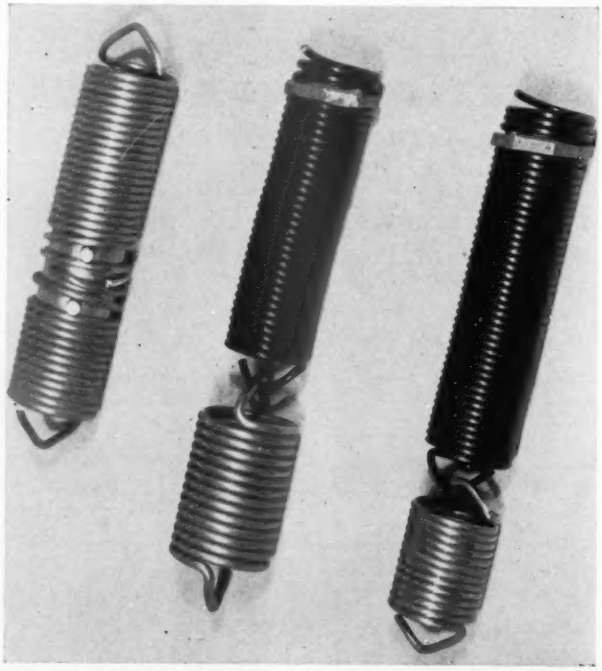

Figure II. Bimetallic Self-Compensating springs for scale application. The shorter section in each case is the overcorrecting section. The first spring is a combination of 36% nickel steel and steel. In the second spring, the correct deflection ratio has been maintained but the coil length has been varied to compensate for zero error. The third spring shown is made of 36% nickel steel and beryllium copper. Not only the calibration, but a final temperature adjustment, may be made by hand. ✦

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Closer Tolerances Possible in Self-Compensating Springs

DUE to the expansion and contraction of certain moving parts of the scales such as the rack, it is usually not desirable to use a spring possessing a thermal coefficient of elastic modulus of zero. For most scales, the ideal coefficient is about -10 x 10^{-6}. If there is a variation from this of ± 5 x 10^{-6}, the net effect upon the stiffness of the spring will be approximately .05% per 100°F temperature change. Considering the effect of the tare load as described above, a variation of .05% at 100°F temperature change will result in an error of a 30 lb. computing scale of ½ ounce over this range or if the scale is sealed at a temperature of 50°F an error at zero and at 100°F of ¼ ounce. The hysteresis error which will always be a positive error should be held within .1% of the total deflection range of the spring. Since the

tare load is at all times imposed on the spring from the time the scale is put in use, the hysteresis in the total scale range should not be greater in percentage than over the total spring range. If the hysteresis in the spring is therefore maintained within +.1%, the scale error due to hysteresis can be controlled within ±¼ ounce. If then, scale spring specifications for temperature effect and hysteresis are written:

Maximum hysteresis	**+.1%**
Maximum variation from specified thermal elastic coefficient	**±.05 x 10⁻⁶**

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THE corresponding maximum error in a 30 lb. computing scale, with tare equal to live load due to either of these effects, will be ±¼ ounce and in a 300 lb. scale ±2¼ ounces.

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THE progress made in the development of self-compensating springs during the past five years has encouraged many scale companies to depart from their general principle of avoiding springs in scale construction. Consequently, tapes, cams, and pendulums have been replaced in many highly accurate scales and testing machines by the self-compensating spring.

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THE coin operated personal weighing machine commonly seen in our railway stations, subways and drug stores has recently been the object of interest of municipal weights and measures officials. In New York City alone, a short time ago, 1/3 of the 1400 scales of this type examined were condemned. At the New York World's Fair, strict standards of accuracy were set up governing this type of weighing machine for use on the Fair grounds. The result of these and similar official actions has been a sincere effort on the part of coin operated personal weighing machine manufacturers to produce a scale which will comply with the most rigid municipal and state specifications. Self-compensating springs have consequently taken the place of cheaper springs in many scales of this type.

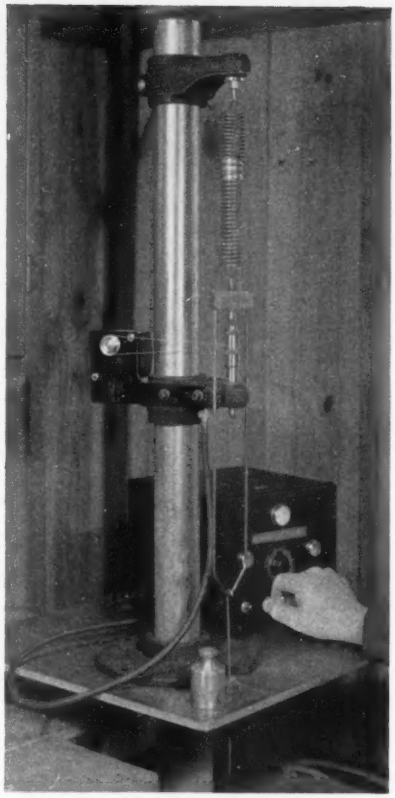

Figure III. Calibrating Self-Compensating springs by means of the Carson Electronic Micrometer. This instrument will accurately measure to better than 1/10,000 of an inch. It eliminates the necessity for any means of mechanical multiplication which might introduce a friction error, and automatically makes "pressureless" measurements.

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THE marked influence exerted upon computing and coin operated scale design has not been the only accomplishment of self-compensating springs. They have established new standards of accuracy for such a varied assortment of products as signalling devices, oil well pressure gauges, gravity meters and testing machines. They are rapidly revising the layman's as well as the engineer's conception of instrument springs and creating a place for springs in products where their use was heretofore believed impracticable.

THE WIRE ASSOCIATION

WHAT IT GIVES YOU FOR $10.00 ANNUAL DUES

1. **WIRE & WIRE PRODUCTS — For One Year.**
   The official publication of The Wire Association covering the Wire Industry; its Metallurgy, Technology, Research, Processes, Machinery and Personnel.
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   (In Association with American Society for Metals and The National Metal Congress.) Technical Sessions, Plant Inspections.
5. **REGIONAL MEETINGS.**
   Attendance at the regional meetings which include Local Plant Inspections, Technical Sessions and Discussions.
6. **PERSONAL CONTACTS.**
   Both at Annual and Regional Meetings, and throughout the year, for interchange of helpful information.
7. **INFORMATION SERVICE ON MACHINERY, EQUIPMENT AND SUPPLIES.**
   The Technical, Catalogue and Correspondence Files of the Wire Association hold the answer to practically every "Where can I buy" problem. This service is available to members without charge.

For detailed information address

RICHARD E. BROWN—Executive Secretary

300 Main Street, Stamford, Conn.

Worcester Wire Works Installs First of New Lee Wilson Furnaces In Wire Industry

By J. L. Whitten,

Sales Manager, Lee Wilson Engineering Co., Cleveland, Ohio

Design with radiant tubes in the inner cover shows marked increase in production and decrease in fuel consumption in progressive New England plant.

THE first installation in the wire industry of the new Lee Wilson cylindrical bell type furnace with the radiant tubes as part of the inner cover was completed several months ago at the Worcester Wire Works Division of the National Standard Company located at Worcester, Mass.

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IN a move to keep the Annealing Department of this plant apace with all other departments and to obtain equipment of exceptional efficiency, the executives of this organization agreed to make the first installation of this new furnace in the late spring of 1940. A vital and peculiar problem involved in this installation was to keep the older annealing equipment in operation during the entire construction period. An exceptionally well arranged program allowed this to be done without the loss of a single pound of annealing capacity.

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BY October the complete installation was ready to operate. Figure No. 1 shows the appearance of the completed job as it is in operation today. The installation consists of three bases, three of the new type of firing retort and two furnace bells.

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THE nomenclature of these furnace components differs somewhat in meaning in this new type unit and this difference is defined as follows:

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1. The furnace base is the same in design as the older furnace installations. Each base contains its high capacity recirculating fan and has an oil seal.

2. The firing retort is an inner cover in which a number of return bend radiant tubes are installed. The lower part of this unit is refractory lined up to the point where the conical alloy hood is welded to the structural steel casing. Each tube is welded to this casing at the firing end while the exhaust end is welded to the alloy sides of the cover. The tube is held in place at the top or return bend, but can float free to meet any of the requirements of expansion. Each tube is thus welded securely in place to be gas tight with reference to furnace atmosphere leakage.

3. The furnace bell is only an insulated cover which retains the heat as generated by the combustion in the tubes. Other than this function, the bell takes no part in the combustion of the furnace gases, except to carry the spark plug igniters and transformers.

THE combustion system on this unit is very different from previous inspirating burner designs. A dual pressure system is employed, with both gas and air supplied at a constant low pressure to the gas and air headers on the firing retort. The end of the burners are completely enclosed so that combustion can only result from the fuel and air passing through the automatic control mechanism. A secondary adjustment on the burners permits a micrometer regulation of the flame length, so that all of the former advantages of close control over the vertical heat application are retained. Further, this system produces complete combustion even at the lowest position of turndown.

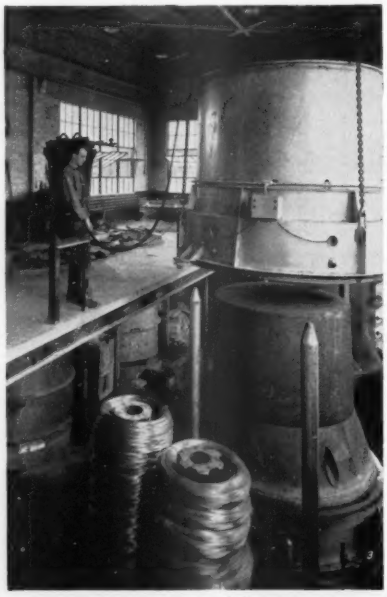

Fig. 1. Furnace Bell being transferred. Firing Retort shown in place on two bases. Note water seal on retort.

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THE advantages of this new type of furnace are readily apparent when its construction is examined. The inner cover is approximately 18 in. larger in diameter than in former designs. This largely increases the radiation area of the furnace. The radiant tube areas can now be added to that of the inner cover for total radiation, so that this area in the new design furnace is twice the former figure. The fan recirculation passes directly over the source of heat and the turbulence of the gases is increased by the protuberance of the radiant tubes in the gas stream. The waste gases pass out of the firing retort and then under the furnace bell to exit through the roof, and in this manner provide the B.t.u, required for radiation losses of the bell.

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THESE features should be expected to improve economies and overall efficiency. From actual operating records, this unit at the Worcester Wire Works is providing 18% more tonnage than the best previous Wilson furnace, at a fuel consumption 15% lower than the best previous records from a Wilson furnace.

BY actual operating records the temperature of the radiant tubes is never more than 50 deg. higher than that of the wire charge, and this condition does not exist longer than 15 minutes. And, what is vitally important is that the tubes cannot be used any more frequently than the inner cover, and this fact, combined with the reduction in tube temperature, differential from 200 deg. to 50 deg., means that tube replacements are not necessary during the normal life of the furnace.

Fig. 2. Firing Retort being lowered over charge. Note air and gas bustles around circumference. Tube shape and location shown in dotted lines.

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THERE are several other features of this design which make it especially adaptable for installation in existing or new wire plants. Since the weight of the furnace is divided between the bell and the retort, the lifting weight is only half of that of the older furnace design. This means that a sizable unit can be handled with a crane as small as 3-ton capacity. The head room required is approximately 2 ft. 0 in. less and this is also of prime consideration for the usual wire mill.

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BEYOND the possibilities of the usual methods for cooling the charge after annealing, this furnace can be cooled faster by blowing air through the radiant tubes. Since the tubes are adjacent to the charge, they can remove a tremendous quantity of heat in this manner.

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FURNACE movements are normal in type and number. Fig. No. 2 shows the operator placing a firing retort over a charge. The floor operated crane makes it possible for one man to handle all furnace movements. The second bell in this installation permits the second charge to be heated while the first charge is being cooled at a slow rate. This method of operation is ideal for spheroidizing, and low carbon tonnages can be considerably increased by substituting some slow cooling time for heating time, but to operate this system to its fullest advantage four bases are required.

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THE installation at the Worcester Wire Works provides a charging base 42 in. in diameter and a charge height of 84 in. On this base one stem of 22 in. wire can be loaded, three stems of 16 in. wire and the equivalent of 6 stems of 8 in. coils. Each base is equipped with a fan delivering 7500 cfm. and is covered with a 25-12 metal sheath for decarburization control on high-carbon charges. Figure No. 3 shows one of the bases loaded. The thermocouple locations are to be seen, as well as the very neat piping arrangement for service lines to the bases.

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THIS installation was made to take care of all wire analyses, oil seals, alloy base covers and complete deoxidizing gas generating equipment provide for handling all carbon ranges. The deoxidizing gas apparatus consists of a gas combuster in which city gas is used to prepare a gas for low carbon wire bright annealing. This gas is dried to a very low dewpoint in a reactivating alumina dryer after it has been desulphurized. For high carbon steels an ammonia cracker is provided. Figure No. 4 shows this accessory equipment.

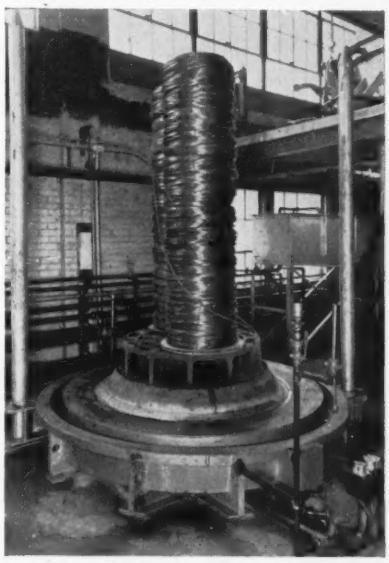

Fig. 3. Base loaded prior to annealing — Note alloy base cover.

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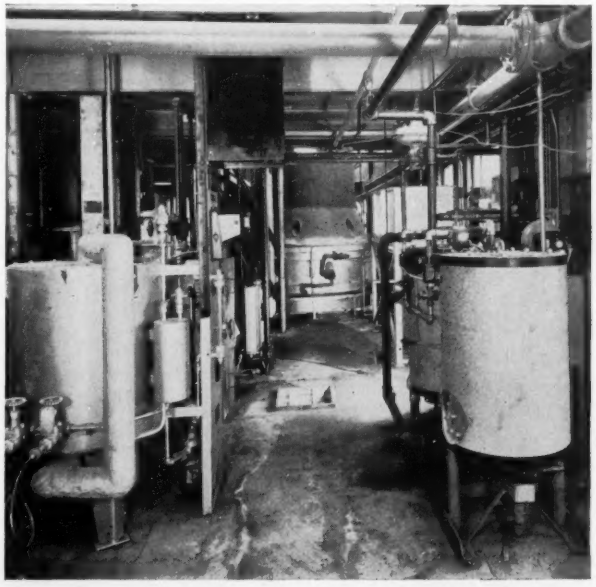

Fig. 4. Gas atmosphere accessory equipment, for low or high carbon steels.

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THIS is a complete modern installation in all senses of the word. The wire stripping machine for loading and unloading the spiders on which the coils are placed was first developed at this plant. This unit was

(*Please turn to Page 131*)

Revised Standard for Tree Wire Promises Wider Popular Use

R. H. Titley,
Chairman, Section 3, Technical Committee 8

by and

D. S. MacCorkle,
Chairman, Technical Committee 8, ASA Committee on Wire and Cable

USERS and suppliers alike welcomed the American Tentative Standard Specifications for Tree Wire Coverings (C8.36-1936) when they were approved by the American Standards Association in 1936, because before that time there were no industry specifications for the coverings of insulated conductors strung where they might contact tree branches. As a result of developments associated with preparation of the standard, the quality of tree wire coverings improved very definitely, and this improvement has been maintained since the standard was issued.

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DURING the period 1936-1940, however, use of the standard proved that certain revisions were desirable. At the same time comment on the tree wire standards which had been developed by the National Electrical Manufacturers Association concurrently with the American Tentative Standard specifications showed that a standard for the complete tree wire rather than for the coverings alone would meet with more popular use. Accordingly, the American Tentative Standard C8.36-1936 has now been revised in keeping with the policy of the American Standards Association to reflect the general demand and practice of the industry.

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THE revised standard, American Standard Specifications for Rubber-Insulated Tree Wire (C8.36-1940), includes requirements for the following essential components of the tree wire in addition to specifications for the wire covering. The requirements refer to the standards listed.

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Conductor

1. American Standard Specifications for Medium-Hard Drawn Copper Wire (H4.3-1940).

2. American Standard Specifications for Tinned or Annealed Copper Wire for Rubber Insulation (H4.4-1940), Sections 3 to 12 inclusive and section 14.

3. American Standard Specifications for Bare Concentric Stranded Cable for Insulated Conductors: Hard, Medium-Hard, or Soft (C8.14-1938).

Insulation

4. American Standard Specifications for Class AO 30 Per Cent Rubber Insulation for Wire and Cable for General Purposes (C8.17-1936).

5. As an alternative insulation, Performance Rubber Compound in accordance with ASTM Specification D 353-39 T.

6. As an alternative insulation, other insulations that may be specified in the purchase order.

Cable Tape

7. When specified, to be in accordance with tape requirements of ASTM Specification D 27-39 T.

Shielding

8. Specified in accordance with satisfactory industry experience — no standard to date.

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THESE additions provide a standard which will be much more practicable, we believe, and will insure its wider use. Although there has been a reduction in the use of tree wire in this country during the past three or four years, there is still a considerable amount in use.

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THE new standard does not revise the requirements for the covering of the tree wire.

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CONTINUED attention is being directed toward development of a combined weatherometer and abrasion test, shielding practices, classification of tree wire constructions with the idea that at least two qualities of tree wire are needed, and other similar problems. Section 3 of Technical Committee 8 is carrying on these investigations:

R. H. Titley, Chairman

E. H. Carr	**D. S. MacCorkle**
G. J. Crowdes	**H. G. Hough**
L. L. Carter	**E. D. Youmans**

THE revised standard prepared by this subcommittee was approved by the ASA Committee on Wire and Cable (C8), was then submitted to the Electrical Standards Committee, the general administrative committee directing the electrical standard program of the American Standards Association, and was finally submitted to and approved by the Standards Council of the ASA.

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COPIES may be obtained from the American Standards Association, 29 West 39 Street, New York, at 20 cents each.

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Tree Wire Standard Prepared By Representative Committee

THE American Standard covering Specifications for Rubber-Insulated Tree Wire, C8.16-1940, was prepared by a representative committee of manufacturers, users, and other interested groups, and is one of a series of standards for wire and cable being prepared by this committee. Members of ASA Committee on Wire and Cable (C8) are:

W. F. Davidson, Electric Light and Power Group, **Chairman.**

G. M. Haskell, National Electrical Manufacturers Association, **Vice-Chairman.**

W. H. Bassett, Jr., American Society for Testing Materials and National Electrical Manufacturers Association, **Secretary.**

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American Institute of Electrical Engineers, C. L. Dawes, W. A. Del Mar, W. N. Zippler

American Society for Testing Materials, W. H. Bassett, Jr., R. W. Chadbourn, F. M. Farmer, Dean Harvey

American Transit Association, C. R. Harte, F. J. White

Association of American Railroads, Engineering Division, Electrical Section, C. R. Troop

(Please turn to Page 131)

Outstanding Personalities of the Wire Industry

David Milne

DAVID MILNE, Machine Shop Superintendent of Farrel-Birmingham Company, Inc., Ansonia, Connecticut, for the past twenty-one years, died at his home in Milford, Connecticut on December 25, 1940.

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MR. MILNE had not been in good health for some time, but had been able to attend to his duties up to the day before he died. He was stricken with a heart attack and the end came on Christmas morning.

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MR. MILNE was born in Montrose, Scotland, September 30, 1878. He served his machinist apprenticeship at the Chapel Works in Montrose and in 1900 went to Canada where he worked as a machinist in a railroad locomotive plant. He came to the United States and in 1907 started work at the Farrel Foundry and Machine Company as a vertical boring mill operator. Mr. Milne was not only an excellent mechanic but also developed exceptional ability as a leader of men. In 1916 he was made a foreman and in 1920 became superintendent of the machine shop.

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HE was especially well informed in the use of machine tools and his wide experience and knowledge enabled him to assist many machine tool builders in improving their designs. Many builders have acknowledged that his critical analysis of the details of their machines and his constructive suggestions were of considerable help to them. He was also very well versed in cutting tools and made a study of various types of tool steels, which he applied to practical use in the shop. He was one of the first to recognize the possibilities of high speed steel and when tungsten carbide came into use he did considerable experimental work with that.

DAVID MILNE

George W. Frick, Mgr., Firthite Division, Firth-Sterling Steel Co.

FIRTH-Sterling Steel Company announces that **George W. Frick,** for nine years manager of its Ohio district, has been made manager of the company's Firthite Division. In this newly created post, he will be in charge of sales of sintered carbide cutting materials.

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HENRY P. JEAGER succeeds Mr. Frick as manager of the Ohio district.

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E. L. Schaffer, Page Steel & Wire, Deceased

E. L. SCHAFFER, formerly District Sales Manager at New York for Page Steel and Wire Division of American Chain & Cable Company, Inc., died at Phoenix, Arizona on December 27th after a long illness.

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MR. SCHAFFER had been associated with the Page Steel and Wire Division for a number of years as District Sales Manager at New York, and before that he held the same position at Pittsburgh. He retired in September, 1939, on account of ill health. He was a veteran of the World War and was active in the American Legion.

Norbert K. Koebel, Research Director, Lindberg Engineering Company

NEWLY appointed Research Director for the Lindberg Engineering Company of Chicago, is **Norbert K. Koebel,** associated for the past four and one-half years with the Eastman Kodak Company as metallurgist. Previous to this, he was at the Battelle Memorial Institute where he conducted research on furnace atmospheres. Koebel, a graduate of Ohio State University, carries degrees of Bachelor of Chemical Engineering, and Master of Science in Metallurgical Engineering.

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RALPH W. STAHL, located for the past year and a half in the Chicago territory as service engineer, has been advanced to manager of the newly opened Lindberg office in Indianapolis, Indiana. The new office serving the Indiana-Kentucky, Tennessee-South Ohio area, is located in the Indianapolis K. of P. Building.

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Fred R. Davis, G-E Advertising Man and A.B.C. Founder Dies at 64

FRED R. DAVIS, a founder of the Audit Bureau of Circulations and advertising space buyer for the General Electric Company at Schenectady for 35 years, died Dec. 26 at his home in Schenectady after an illness of two years. He was 64 years old. For many years he supervised the expenditure of more than a million dollars annually for newspaper and magazine space.

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A MAN of scientific training himself, Mr. Davis was a pioneer advocate of accurate measurement in advertising and helped found the Audit Bureau of Circulations in 1914. He served as a director from that date until his death and since 1927 had also been first vice president of the organization.

(*Please turn to Page 127*)

STATISTICS --- NOVEMBER, 1940

PRODUCTION FOR SALE OF IRON AND STEEL PRODUCTS

AMERICAN IRON AND STEEL INSTITUTE
Capacity and Production for Sale of Iron and Steel Products

November - 1940
PERIOD

		Number of companies	Items	Annual Capacity Net tons	Production for Sale—Net Tons							
					Current Month				To Date (11 Months - 1940)			
					Total	Per cent of capacity	Shipments: Export	Shipments: To members of the industry for conversion into further finished products	Total	Per cent of capacity	Shipments: Export	Shipments: To members of the industry for conversion into further finished products
STEEL PRODUCTS	Ingots, blooms, billets, slabs, sheet bars, etc.	34	1	xxxxxxx	540,222	xxx	202,502	123,304	5,056,332	xxx	2,372,787	1,071,844
	Heavy structural shapes	8	2	5,205,300	373,825	87.5	36,113	xxxxxxx	2,817,737	59.1	374,070	xxxxxxx
	Steel piling	4	3	328,000	26,988	100.3	1,950	xxxxxxx	194,938	64.9	19,523	xxxxxxx
	Plates—Sheared and Universal	20	4	6,095,450	432,680	86.5	63,991	2,312	3,747,524	67.2	572,186	19,323
	Skelp	8	5	xxxxxxx	91,331	xxx	18,198	41,414	764,660	xxx	163,714	280,099
	Rails—Standard (over 60 lbs.)	4	6	3,647,600	95,813	32.0	11,894	xxxxxxx	1,376,858	41.2	189,103	xxxxxxx
	Light (60 lbs. and under)	6	7	306,800	14,134	56.1	5,731	xxxxxxx	117,007	41.7	44,949	xxxxxxx
	All other (Incl. girder, guard, etc.)	2	8	118,000	4,144	42.8	892	xxxxxxx	25,253	23.4	4,621	xxxxxxx
	Splice bar and tie plates	15	9	1,300,200	21,746	20.4	939	xxxxxxx	455,022	38.2	9,699	xxxxxxx
	Bars—Merchant	35	10	xxxxxxx	495,011	xxx	46,946	50,884	4,268,501	xxx	664,142	339,975
	Concrete reinforcing—New billet	16	11	xxxxxxx	120,777	xxx	14,773	xxxxxxx	1,193,211	xxx	248,803	xxxxxxx
	Rerolling	18	12	xxxxxxx	9,429	xxx	884	xxxxxxx	133,000	xxx	8,860	xxxxxxx
	Cold finished—Carbon	18	13	xxxxxxx	77,080	xxx	4,073	xxxxxxx	637,836	xxx	20,776	xxxxxxx
	Alloy—Hot rolled	16	14	xxxxxxx	118,535	xxx	11,591	11,287	928,931	xxx	82,096	70,733
	Cold finished	15	15	xxxxxxx	10,246	xxx	961	xxxxxxx	88,458	xxx	4,578	xxxxxxx
	Hoops and baling bands	5	16	xxxxxxx	6,756	xxx	514	xxxxxxx	93,088	xxx	8,484	xxxxxxx
	TOTAL BARS	54	17	12,389,265	837,834	82.4	79,742	62,171	7,343,025	64.7	1,037,739	410,708
	Tool steel bars (rolled and forged)	15	18	110,220	7,685	85.0	933	xxxxxxx	65,664	65.1	5,913	xxxxxxx
	Pipe and tube—B. W.	13	19	1,851,860	128,400	84.5	7,481	xxxxxxx	1,017,101	60.0	71,836	xxxxxxx
	L. W.	10	20	1,246,340	32,947	32.2	2,540	xxxxxxx	325,822	28.6	30,545	xxxxxxx
	Electric weld	5	21	735,520	22,097	36.6	2,464	xxxxxxx	257,021	38.2	27,832	xxxxxxx
	Seamless	15	22	3,159,840	152,102	58.7	14,303	xxxxxxx	1,631,708	56.4	191,574	xxxxxxx
	Conduit	6	23	151,145	8,657	69.8	142	xxxxxxx	72,267	52.2	1,650	xxxxxxx
	Mechanical Tubing	13	24	554,825	33,220	73.0	3,157	xxxxxxx	273,446	53.8	22,607	xxxxxxx
	Wire rods	18	25	xxxxxxx	107,394	xxx	14,334	19,738	1,120,025	xxx	320,702	174,939
	Wire—Drawn	37	26	2,255,210	165,548	89.5	11,822	1,392	1,387,121	67.2	155,580	11,022
	Nails and staples	19	27	1,091,690	60,656	67.7	3,265	xxxxxxx	577,053	57.7	54,947	xxxxxxx
	Barbed and twisted	16	28	438,270	17,924	49.8	4,518	xxxxxxx	192,261	47.9	47,871	xxxxxxx
	Woven wire fence	15	29	772,790	14,874	23.5	131	xxxxxxx	207,584	29.3	1,943	xxxxxxx
	Bale ties	11	30	119,050	3,925	40.2	29	xxxxxxx	63,546	58.3	294	xxxxxxx
	All other wire products	5	31	27,030	409	18.4	-	xxxxxxx	4,867	19.7	-	xxxxxxx
	Fence posts	13	32	147,485	4,006	33.1	15	xxxxxxx	49,965	37.0	862	xxxxxxx
	Black plate	12	33	653,295	24,090	44.9	4,141	73	316,631	52.9	43,094	56,084
	Tin plate—Hot rolled	9	34	1,201,960	22,572	22.9	356	xxxxxxx	404,514	36.8	75,132	xxxxxxx
	Cold reduced	10	35	2,930,860	177,529	73.8	9,402	xxxxxxx	2,081,921	77.6	308,751	xxxxxxx
	Sheets—Hot rolled	26	36	xxxxxxx	584,715	xxx	34,914	12,540	5,163,064	xxx	476,733	144,618
	Galvanized	16	37	xxxxxxx	147,142	xxx	10,629	xxxxxxx	1,399,551	xxx	145,138	xxxxxxx
	Cold rolled	18	38	xxxxxxx	267,525	xxx	4,652	xxxxxxx	2,181,858	xxx	69,689	xxxxxxx
	All other	15	39	xxxxxxx	60,263	xxx	1,594	xxxxxxx	539,734	xxx	21,724	xxxxxxx
	TOTAL SHEETS	27	40	13,255,610	1,059,645	97.4	51,789	12,540	9,280,207	76.5	713,284	144,618
	Strip—Hot rolled	24	41	3,525,110	155,967	53.9	7,789	18,009	1,370,176	42.5	81,944	159,824
	Cold rolled	35	42	1,313,360	83,076	77.1	1,173	xxxxxxx	701,644	58.4	15,824	xxxxxxx
	Wheels (car, rolled steel)	5	43	424,385	17,305	49.7	45	xxxxxxx	171,777	44.2	2,529	xxxxxxx
	Axles	5	44	472,280	14,037	36.2	434	xxxxxxx	94,211	21.8	2,319	xxxxxxx
	Track spikes	11	45	327,275	7,948	29.6	360	xxxxxxx	97,312	32.5	3,903	xxxxxxx
	All other	3	46	9,100	218	29.2	12	xxxxxxx	8,987	107.9	12	xxxxxxx
	TOTAL STEEL PRODUCTS	134	47	xxxxxxx	4,760,948	xxx	562,587	280,953	43,671,187	xxx	6,969,339	2,328,461
	Estimated total steel finishing capacity based on a yield from ingots of 68.9 %	-	48	53,946,300	xxxxxxx	101.2	xxxxx	xxxxxxx	xxxxxxx	83.7	xxxxxxx	xxxxxxx
	Pig iron, ferro manganese and spiegel	25	49	xxxxxxx	595,351	xxx	7,180	206,776	5,398,328	xxx	491,061	1,507,997
	Ingot moulds	4	50	xxxxxxx	60,456	xxx	81	xxxxxxx	449,952	xxx	4,451	xxxxxxx
IRON PRODUCTS	Bars	10	51	160,600	3,139	23.8	-	56	29,530	20.1	364	1,772
	Pipe and tubes	3	52	109,377	4,649	51.8	158	xxxxxxx	39,535	39.5	1,008	xxxxxxx
	All other	3	53	71,180	1,693	29.0	347	-	11,607	17.8	2,523	2,326
	TOTAL IRON PRODUCTS (ITEMS 51 to 53)	12	54	276,247	9,481	41.8	505	56	80,672	31.9	3,895	4,098

Total number of companies included..... 153

Total steel products produced for sale, less shipments to members of the industry for conversion into further finished products: Current month 4,479,995 *N.T.;* 101.2 *% of Finishing Capacity.*
To date 41,342,726 *N.T.;* 83.7 *% of Finishing Capacity.*
The above tonnages represent 68.9 *% of the ingots produced by companies whose products are included above.*

GOING TO PRESS MARCH 1st, 1941

THE 1941 EDITION OF THE

WIRE
& WIRE PRODUCTS'

Buyers Guide
and Year Book of the
WIRE ASSOCIATION

Exports and Imports of Wire

Exports of Iron and Steel Wire Products in Nov. 1940 and Nov. 1939
(In gross tons)

	NOV. 1940	OCT. 1940	NOV. 1939
Wire rods	22,169	31,253	4,236
Strip steel	19,054	16,571	9,863
Plain, black or galvanized iron or steel wire	11,689	11,730	6,974
Barbed wire and woven wire fencing	4,491	7,444	6,681
Woven wire cloth	363	275	246
Wire rope	1,273	1,113	548
Insulated iron or steel wire and cable—see analysis below			
Other wire and manufactures	1,343	1,802	1,195
Wire nails	2,952	2,201	4,210
Tacks	65	65	33
Other nails, including staples	558	336	826
Bolts, machine screws, nuts, rivets and washers	4,619	5,286	963
Total, these 11 classifications	68,576	78,076	35,955

Imports of Iron and Steel Wire Into the United States
(In gross tons)

Concrete reinforcement bars	.....	.....	15
Hollow bar and drill steel	1	15	71
Wire rods	.....	.....	917
Barbed wire	.....	.....	174
Round iron and steel wire	5	.....	166
Telephone and telegraph wire	1	.....	.....
Flat wire and strip steel	105	.....	226
Wire rope and strand	13	16	121
Other wire	.....	.....	45
Hoops and bands	.....	10	363
Nails, tacks and staples	1	1	162
Bolts, nuts and rivets	1	.....	9
Total, these 12 classifications	127	42	2,269

Exports of Insulated Wire and Cable, November, 1940

	Foreign		To U. S. Possessions	
	Pounds	Dollars	Pounds	Dollars
Rubber covered wire	693,451	$175,568	158,379	$ 34,119
Weatherproof wire	187,785	31,039	158,963	24,476
Other insulated copper wire	2,221,287	468,860	682,537	116,792
Nickel-chrome electric resistance wire	60,959	50,123	645	613
Total, these 4 classifications	3,163,482	$725,590	1,000,524	$176,000

Iron and Steel Exports

FOR the third successive month exports of iron and steel (except scrap) from the United States declined in November. During November 713,827 gross tons of these materials valued at $42,863,811 moved to foreign markets registering declines of 15.7 percent in quantity and of 9.3 percent in value as compared with the October trade of 846,485 tons valued at $47,244,586. A year earlier, in November 1939, this trade amounted to 332,899 tons valued at $22,791,622.

✦ ✦ ✦

EXPORTS during the first 11 months of 1940 aggregated 7,050,362 tons valued at $432,091,928, or, roughly, three times greater than the 2,104,967 tons valued at $150,896,242 exported during the corresponding months of 1939.

✦ ✦ ✦

THE United Kingdom, although buying less iron and steel than in October, continued to be the chief export market with its November purchases of 400,953 tons comprising 56 percent of the month's total trade. Canada ranked second with purchases totaling 83,946 tons, and was followed by the Union of South Africa, 34,297 tons, Netherlands Indies, 19,657, and Brazil, 19,240.

✦ ✦ ✦

AS in immediately preceding months nonalloy ingots, blooms, and billets continued to be the chief material exported—the 226,437-ton total including 206,202 sent to the United Kingdom, 11,347 to Canada, and 3,811 to Japan. Second place in point of tonnage went to alloy ingots, blooms, and billets, with a total of 58,404 tons, of which the United Kingdom took 52,083 and Canada 6,312.

✦ ✦ ✦

OTHER outstanding items in the November trade included exports of nonalloy "other" plates amounting to 54,440 tons, including 25,329 tons taken by the United Kingdom and 10,956 by Canada; nonalloy black steel sheets, 42,706 tons, including 12,945 exported to Canada, 7,697 to the United Kingdom, and 7,471 to the Netherlands Indies; and nonalloy "other" steel bars, 37,950 tons, of which 12,672 went to the United Kingdom, 4,864 to the Union of South Africa, and 2,945 to Canada.

✦ ✦ ✦

Imports

IRON and steel imports in November reached a new low with the total for the month aggregating 728 gross tons, valued at $165,009 which compared with 3724 gross tons imported in the preceding month, valued at $196,854, but were sharply lower than the 14,379 gross tons valued at $1,005,774 recorded in November 1939.

✦ ✦ ✦

CUMULATIVE imports during the period from January 1, 1940 to November 31, 1940 amounted to 51,261 tons, valued at $5,890,441 and that of the comparable period of 1939 amounted to 272,227 tons, valued at $21,135,399.

✦ ✦ ✦

CHIEF suppliers during the month, were in point of tonnage, Canada, 355 tons, Sweden, 295 tons and the United Kingdom with 61 tons.

✦ ✦ ✦

SCRAP imports during November totaled 252 tons, valued at $3,519 compared with 242 tons, valued at $3,351 in October. Of this total, Honduras contributed 149 gross tons, Mexico 99 gross tons and Canada four tons.

✦ ✦ ✦

Scrap Exports Register Sharp Decline

EXPORTS of scrap from the United States in November, the first complete month in which

(*Please turn to Page 126*)

Exports and Imports of Wire

(*Continued from Page 125*)

shipments were subject to license, totaled only 74,349 gross tons valued at $1,303,814. Exports of these materials in October amounted to 258,926 tons valued at $4,650,299, and in November 1939, 272,656 tons valued at $5,173,374.

✦ ✦ ✦

DURING the first 11 months of 1940, 2,753,108 tons of scrap valued at $47,012,303 were exported to foreign countries—approximately 18 percent less in quantity and 9 percent in value compared with the trade in the same period of 1939, which amounted to 3,371,025 tons valued at $51,746,059.

✦ ✦ ✦

INCLUDED in the November total were 73,809 tons of iron and steel scrap. Of this amount 35,709 tons went to Canada, 33,971 to the United Kingdom, and 2,685 to Honduras. All of the 25 tons of tin plate scrap exported went to Japan, while China took practically all of the 396 tons of tin plate circles, cobbles, and similar products exported. China was also the outstanding buyer of waste—waste tin plate taking 56 tons of the 97-ton total, with the balance going to Thailand. The entire 22 tons of terne plate scrap exported went to China.

✦ ✦ ✦

Bale Ties for India

INDIA is reported looking to the United States for the ties with which to bale its 1940 cotton crop. Estimates place the total of "hoops" required for this purpose at 22,000 tons. Not all this quantity must be imported, however, since there are some stocks and since, in the face of limited imports, used ties will be more extensively employed than they have been in the past. The supply of new and used ties available in India is expected to be sufficient to meet the initial demand anticipated for September, while giving time for supplies ordered from Great Britain, Japan, and the United States to arrive. Indian production of cotton ties and baling bands is described as negligible. (American Consulate, Bombay.)

Canadian Iron & Steel Industry

THIRTY-NINE companies operating 54 plants and employing $113,660,251 as capital comprised the primary iron and steel industry of Canada in 1939. An average of 13,827 employees is reported for the year, with salaries and wages paid totaling $20,410,517. Materials consumed cost $29,629,376 and outlay for fuel and electricity was $61,174,661; gross selling value of products turned out was $75,934,481. These figures represent substantial increases in every item over 1938, despite the closing of one plant.

✦ ✦ ✦

Electrical Machinery and Equipment

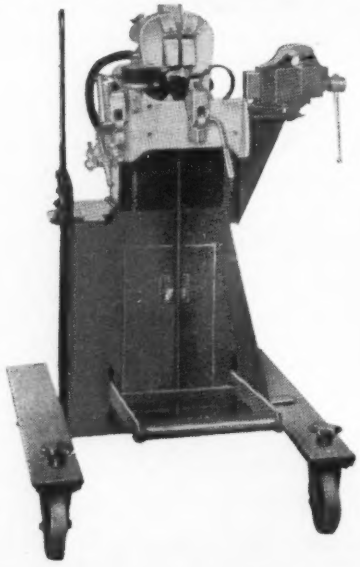
EXPORTS of electrical machinery and apparatus during the first 10 months of 1940 indicate that the total for the full year will exceed that of 1939 by about 10 percent. Included in the total were insulated copper wire

MICROMETER PRECISION MICRO-WELD TRADE MARK REG. U. S. PAT. OFF.

CONTINUOUS IMPROVEMENT

MICRO-WELDERS with dial indicating annealing attachments are now available for high carbon wire.

There is positive control of annealing temperature and already hundreds of these special MICRO-WELDERS are proving their dependability and satisfactory performance with leading manufacturers.



MICRO PRODUCTS COMPANY
20 NORTH WACKER DRIVE, CHICAGO, ILL.
Telephone, State 7468

and cable amounting to $15,584,000.

✦ ✦ ✦

A NEW low for the year in shipments from United States of rubber-covered wire was reached in October when 677,700 pounds valued at $144,735 were exported compared with 1,008,777 pounds valued at $232,849 in September, a decrease of 33 percent in quantity and 38 percent in value.

✦ ✦ ✦

OF the total quantity of electrical goods ($90,000,000) made in purely electrical works in 1938, the largest contribution consisted of wires and cables (not including aluminum) with an aggregate value of $12,626,000.

✦ ✦ ✦

EXPORTS of rubber-covered wire, valued at $289,430 in August, dropped to $232,849 in September, approaching the January low for the year of $208,918.

✦ ✦ ✦

Outstanding Personalities of the Wire Industry

(*Continued from Page 123*)

MR. DAVIS was born in Adams, Mass., attended Union College in Schenectady, and was graduated from Worcester Polytechnic Institute in 1900 with the degrees of B.S. and M.S. in engineering. In 1901, he entered the G-E organization as a test student and in 1902 went to Fort Wayne, Ind., as publicity manager of the Fort Wayne Electric Company. In 1905 he joined the G-E advertising department in Schenectady.

✦ ✦ ✦

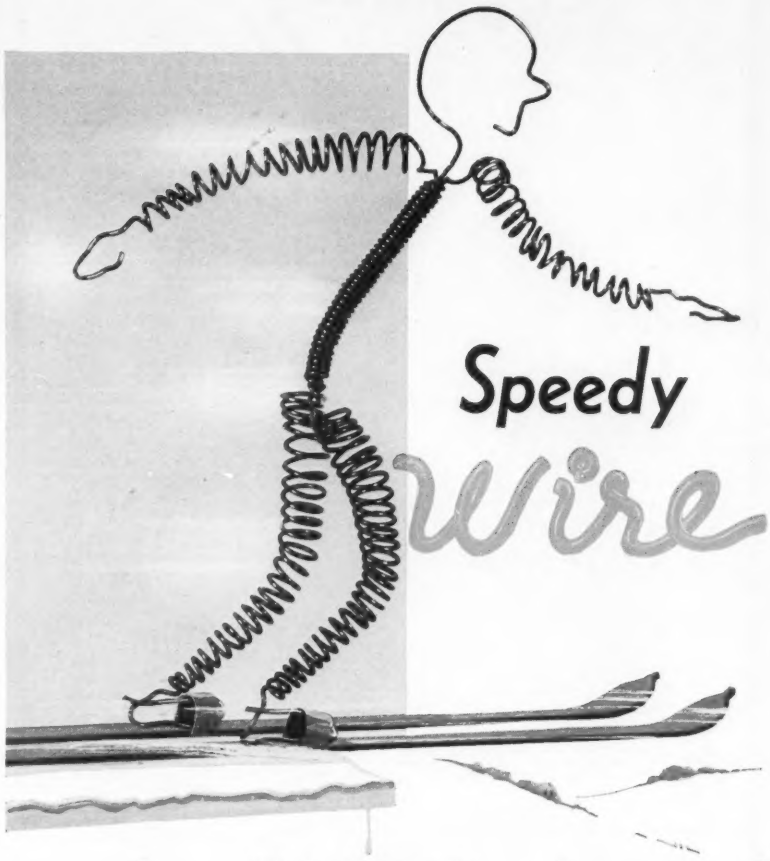
F. E. Whittlesey, Gen. Mgr., Raymond Mfg. Co., Retires

F. E. WHITTLESEY, general manager, Raymond Mfg. Co., Corry, Pa., will retire from active management Dec. 31, after having completed 50 years with the company. He will continue as vice president and assistant treasurer, in an advisory capacity.

✦ ✦ ✦

E. W. FELDT becomes vice president and general manager in charge, and C. H. Holden, vice

(*Please turn to Page 128*)



. . . for *FAST* Production!

Possibly your product fabrication isn't getting off to the fast start you expected. If quality seems to vary too much, costs are mounting — give Keystone wire a try. It's absolutely UNIFORM in tensile strength, analysis, gauge and finish. Keystone metallurgists and technicians have seen to that. You may need a SPECIAL wire, or, perhaps some of our regularly stocked wires will do. Just send us the word and we'll have samples in your office in a hurry.

KEYSTONE

STEEL & WIRE CO. Dept. W PEORIA, ILLINOIS

HIGH CARBON OR LOW CARBON

SAMSON SPRING WIRE

Bright-Tinned
Coppered
Annealed
Galvanized

ASSEMBLE *Your Own* ?

But you'll find it generally works better when it's *all* engineered by *one maker!*

For perfect correlation of equipment for lead encasing cables, invest in a complete unit with all items from one maker. Correlated equipment is installed with less trouble and lost motion — responsibility is undivided; it operates as a unit, each machine a complement of the others; properly engineered, it forms a perfectly working whole — smoothly producing.

For these reasons, many of the leading producers of lead encased cables standardize on Robertson equipment. Further, practically all manufacturers of lead encased cables use Robertson products . . . a double indication of the worth of the products and the reputation of their maker.

We invite your most rigid investigation. Write John Robertson Co., Inc., 125-137 Water St., Brooklyn, N. Y.

ROBERTSON CABLE LEAD ENCASING EQUIPMENT

HYDRAULIC PRESS · HIGH PRESSURE HYDRAULIC PUMP · CLOSED LEAD MELTING POT

Outstanding Personalities of the Wire Industry

(*Continued from Page 127*)

president and assistant treasurer in charge of purchasing, accounting departments and financial matters, effective Jan. 1.

✦ ✦ ✦

MR. WHITTLESEY joined the Raymond Mfg. Co. Jan. 1, 1891, when the company was very small. His nominal title was secretary, but his duties included keeping the books, billing, writing letters, packing the goods, and sometimes making them.

✦ ✦ ✦

THE company manufactured a line of goods in which springs were used and contributed much to the development of superior springs at the beginning of at least three major industries, bicycles, automobiles and airplanes. Mr. Whittlesey designed and built many machines for spring manufacture when such machines could not be purchased on the market. For the past 40 years the company has concentrated on manufacture of springs and stampings.

✦ ✦ ✦

MR. WHITTLESEY became general manager in 1909. He is a member of the American Society of Mechanical Engineers, Society of Automotive Engineers, and the American Society for Metals.

✦ ✦ ✦

James A. Gillis, American Steel & Wire Co.

JAMES A. GILLIS, former member of the New York order department of the American Steel & Wire Co., U. S. Steel Corp. subsidiary, has been appointed supervisor of warehouses, a newly created position with headquarters in the company's main office in Cleveland.

✦ ✦ ✦

MR. GILLIS was first employed by American Steel & Wire in 1914 and has been in both the Boston and New York offices before his present appointment.

A Review of Recent Wire Patents

No. 2,223,354, WIRE KNITTING MACHINE, patented December 3, 1940 by Floyd O. De Millar, Warwick, R. I., assignor to Elastic Knitted Wire Co., Inc., a corporation of Rhode Island.

The method, in this patent, for forming a tube of wire, comprises continually winding a strip of wire having laterally displaced coils in helical rows, and successively interlocking the coils of each row with the preceding row. There are 20 claims, in all.

✦ ✦ ✦

No. 2,223,390, WIRE FABRIC AND METHOD OF MAKING THE SAME, patented December 3, 1940 by Otto Carl Scherfel, Haddon Heights, N. J., assignor to Audubon Wire Cloth Corporation, Philadelphia, Pa., a corporation of New Jersey.

Helically coiled wires, arranged in pairs, are provided, with the spirals of the wires of each pair in aligned relation and offset laterally with respect to each other; the wires having their ends permanently connected together and each wire of each connected pair being in interconnected relation with a wire of different adjacent connected pairs of wires.

✦ ✦ ✦

No. 2,224,300, MATTRESS AND METHOD OF MANUFACTURING THE SAME, patented December 10, 1940 by James Reid Johnson, New London, Conn., assignor to The Palmer Brothers Company, New London, Conn., a corporation of Connecticut.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

More specifically, the invention relates to textile tapes, interlaced with the wire springs and with the tapes secured one to another.

✦ ✦ ✦

No. 2,224,323, WIRE FABRIC SEAM, patented December 10, 1940 by William J. Taylor, Nutley, New Jersey.

For joining wire fabric ends, each of the ends having a terminal weft wire with the cut free ends of the warp wires extending past the weft wires, and a wire of fusible material cooperative with the cut free ends of the warp wires for temporarily holding the warp wires in position until the fusible material is caused to melt and securely attach the ends together.

✦ ✦ ✦

No. 2,225,187, WIRE HANDLING MACHINE, patented December 17, 1940 by Claude M. Stitt, Antioch, Harry C. Stone, Burlingame, and Floyd B. Stone, San Francisco, Calif., assignors to Fibreboard Products, Inc., San Francisco, Calif., a corporation of Delaware.

This assembly includes a pair of pivotally mounted arms for bending portions of a wire up from an intermediate portion to form sides of a loop, a second pair of pivotally mounted arms for bending the end portions of the wire inwardly to form another side of the loop, and means for fastening the ends of the wire together to close the loop.

✦ ✦ ✦

No. 2,225,298, INSULATED WEATHERPROOF WIRE, patented December 17, 1940 by William E. Cook, West New Brighton, N. Y.

The covering for the wire comprises an inner stratum of asphaltum compound having a high melting point in continuous contact with, and closely adherent to, the conductor wire, an inclosing dam or barrier of non-deformable material impenetrable by the heavier constituents of the asphaltum compound, and a body of fibrous material inclosing and contacting with the dam or barrier, the fibrous body being impregnated with an asphaltum compound having a relatively lower melting point than the asphaltum compound in the inner stratum.

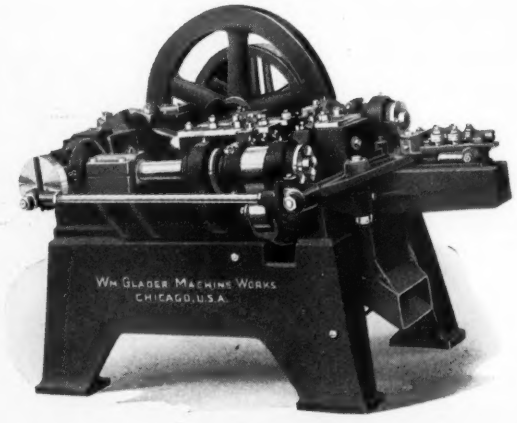
✦ ✦ ✦

No. 2,226,006, CORRUGATED METAL FASTENER, patented December 24, 1940 by James S. Maze, Peru, Illinois, assignor to W. H. Maze Company, Peru, Illinois, a corporation of Illinois.

Embracing the conventional nail head, is a lead head. There is a continuous

(Please turn to Page 130)

HIGH SPEED WIRE NAIL MACHINE



WM. GLADER MACHINE WORKS

210 N. Racine Ave. Chicago, Illinois

Glader Machines on large head, single-blow roofing nails can be seen in operation at any of the independent wire mills in the United States.

The production figures on common nails shown below, are guaranteed.

SIZE MACH.	SIZE WIRE	MAX. LENGTH OF WIRE	NUMBER OF NAILS PER MIN.	CAP. IN POUNDS PER HR.
#00A	#16	1⅛"	700	37.2
#00	#14	1¼"	550	55
#0	#12	1¾"	450	89
#1	#10	2½"	400	192
#2	#8	3½"	325	310
#3	#4	5"	225	523
#4	#1	7"	190	622
#4s	5/16"	9"	175	1155
#5	⅜"	12"	160	2400

This high output and economical operation account for the GLADER machine being accepted as standard equipment in all recent installations.

A Review of Recent Wire Patents

(Continued from Page 129)

helical groove in the nail shank which terminates above the tapered point.

✦ ✦ ✦

No. 2,226,016, WIRE DRAWING MACHINE, patented December 24, 1940 by Robert C. Pierce, Niles, Michigan, assignor to National Standard Company, Niles, Michigan, a corporation of Michigan.

A wire treating apparatus is provided, comprising a capstan having a cylindrical peripheral surface having at one edge a flange merged into the surface on a wide radius and having an annular closed water-cooling passage directly beneath the portion where the flange merges into the cylindrical surface, a partition blocking the passage at one point, and radial inlet and outlet water conduits opening into and from the passage on the opposite sides of and adjacent the partition.

✦ ✦ ✦

No. 2,226,040, INNER SPRING STRUCTURE, patented Dec. 24, 1940 by Robert Chester Winders, Los Angeles, Calif.

This assembly includes a number of coil springs in pairs, one of each pair being provided at the free end of one end coil with a substantially U shaped loop disposed opposite a portion of the corresponding end coil of the other spring, which portion is spaced from the free end of the second named end coil, a sinuous spring wire tie member extending under and then over the second named end coil on one side of the portion then laterally around the loop and then over and under the second named end coil on the other side of the portion, the tie member and the portion closing the loop and forming therewith an eye, and a flexible tie member threaded through the eye, the first named end coil having a hook contiguous with the loop, under which hook the sinuous tie element extends in embracing the loop.

✦ ✦ ✦

No. 2,226,400, WIRE DRAWING MACHINE, patented December 24, 1940 by Frederick W. Gaines, 3rd, Cleveland Heights, Ohio, assignor to The Ajax Manufacturing Company, Euclid, Ohio, a corporation of Ohio.

A gripping means is provided for intermittently gripping the wire stock for preventing backward movement of the stock, this gripping means being between the die and the wire-feeding device.

✦ ✦ ✦

No. 2,226,491, SELF - LOCKING SCREW, BOLT, NUT, OR THE LIKE, patented December 24, 1940 by Carl W. Gustafson, New Bedford, Mass., assignor to Continental Screw Company, New Bedford, Mass., a corporation of Massachusetts.

Upon the under side of the screw are a number of wings, twisted at predetermined angles.

✦ ✦ ✦

No. 2,226,590, INSULATED ELECTRIC CONDUCTOR, patented December 31, 1940, by William H. Smyers, Westfield, N. J., assignor to Standard Oil Development Company, a corporation of Delaware.

Invention lies in the insulation which comprises a flexible rubber, having a colloidal cellular structure, in which an isobutylene polymer having a molecular weight above 2,000 is homogeneously and intracellularly dispersed.

✦ ✦ ✦

No. 2,226,938, METHOD OF COATING WIRE, patented December 31, 1940 by Benjamin Lewis McCarthy, Buffalo, N. Y., assignor to Wickwire Spencer Steel Company, New York, N. Y., a corporation of Delaware.

The wire is immersed in an acidified solution of copper sulphate and ammonium molybdate, to provide a coating, and rubber is then vulcanized to the coated wire.

✦ ✦ ✦

No. 2,226,967, PRODUCTION OF STAINLESS STEELS, patented December 31, 1940 by Edward J. Chelius, Pittsburgh, Pennsylvania.

This method includes charging solid ferrous material, containing chromium and carbon, into a melting furnace, heating the material in the furnace until it partially melts to form a molten bath and introducing oxygen into the bath to rapidly raise its temperature, the introduction of the oxygen being started before all of the material is melted.

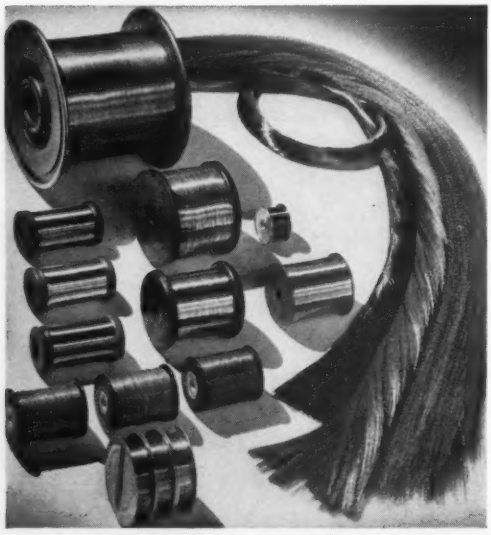
✦ ✦ ✦

John E. Shook, Vice Pres. in Charge of Operations, Mercer Tube & Mfg. Co.

JOHN E. SHOOK, superintendent of the Mercer Tube & Mfg. Co., Sharon, Pa., has been named vice-president in charge of operations.

WHERE PROFITS HANG ON A TINY WIRE STRAND

Profits fly out the window for the paper maker if the continuous operation of his giant Fourdrinier machine is interrupted. So he takes precautions — such as using wire mesh made of Callite Wire. In every industry where dependability is so vital, Callite gets the call. There's a Callite wire in standard and special alloys down to .002" for every fabricating need. And if you have a *special* requirement, experienced Callite metallurgists will create *special wires* for you.



Write for

COMPLETE DETAILS

Callite wires are available in aluminum, steel, stainless steel, Everdur, brass — all grades, brush wire, commercial bronze, Fourdrinier, phosphor bronze, nickel-silver alloys and in combinations of these and other alloys. In round, flat and special shapes in sizes down to .002".

CALLITE WIRES

CALLITE-TUNGSTEN CORPORATION

564-39th STREET • UNION CITY, N. J.

Branch Offices: Chicago, Ill. • Cleveland, O.

A WIRE FOR EVERY NEED — CALLITE TUNGSTEN — C-T

Worcester Wire Works Installs First of New Lee Wilson Furnaces

(*Continued from Page 121*)

rebuilt to the most up-to-date specifications and is now in regular service.

✦ ✦ ✦

THE splendid cooperation of the local management, operating and engineering staff, with the furnace engineers, made it possible to obtain authoritative information on the operating results so quickly. The willingness of the executives of this company to pass on this information to the wire industry is evidence of a truly fine spirit.

✦ ✦ ✦

Data on Installation

Furnace designed and erected by Lee Wilson Engineering Company.
Charge Size, 42 in. dia x 84 in. high.
Number of bases—3.
Number of furnace retorts—3.
Number of furnace bells—2.
Fuel — Anthracite producer gas — 2# pressure.
Combustion system—dual pressure.
Base seals—oil.
Recirculating fans, 7500 cfm.
Deoxidizing gas — Partially combusted city gas—dried to minus 46 deg. F. dewpoint;
—Cracked ammonia.

Furnace Charges	22″ Coils	16″ Coils	8″ Coils
Number of stems	1	3	6 (in tubs)
Weight per stem	4800#	2800#	800#
Total charge	4800#	8400#	4800#
Heating Cycle	4½ hrs.	7 hrs.	5 hrs.
Daily production (24 hours)	12¾ tons	14½ tons	11½ tons

Wire uniformity—4,000#/sq. in. maximum difference in charge by check on both ends of every coil.

✦ ✦ ✦

Revised Standard for Tree Wire Promises Wider Popular Use

(*Continued from Page 122*)

Association of American Railroads, Engineering Division, Signal Section, J. J. Corcoran
Association of American Railroads, Mechanical Division, Electrical Section, J. R. Sloan
Electric Light and Power Group, W. F. Davidson, G. E. Dean, C. T. Sinclair, A. B. Campbell (alt.), J. H. Foote (alt.)
International Municipal Signal Association, Inc., Dr. M. G. Lloyd, Jay B. Franke (alt.)

This is an invitation for you to become a member of The Wire Association. ✦ ✦ ✦ ✦ ✦ ✦

The Annual Dues are $10.00

National Board of Fire Underwriters, A. H. Nuckolls
National Bureau of Standards, U. S. Department of Commerce, Dr. J. Franklin Meyer
National Electrical Manufacturers Association, W. H. Bassett, Jr., G. M. Haskell, C. O. Hull, Moss A. Kent, E. D. Youmans
National Fire Protection Association, R. B. Shepard
Society of Automotive Engineers, F. W. Andrew
Telephone Group, C. S. Gordon
U. S. Navy Department, Bureau of Engineering, Specification Section, Design Division, Officer in Charge; Laboratory Officer of Material Laboratory (alt.)
U. S. War Department, Captain Arthur J. Sheridan

THIS committee, working through technical subcommittees, has now completed twenty standards for wire and cable.

Here's why you "Save with Syncro"

Every individual unit of the entire Syncro line is superbly designed and built to give you complete and lasting satisfaction. No part is too small to receive the most painstaking care in both design and construction — which explains the high efficiency and low maintenance of Syncro machines.

When you are in the market for wire drawing machinery, insulating machinery for applying all materials (including cellulose acetate, paper, silk and cellophane), taping heads, capstans, annealing and tinning units or allied machinery, remember that you can "save with Syncro" equipment.

SYNCRO MACHINE COMPANY
420 LEXINGTON AVE., NEW YORK
McCORMICK BLDG., CHICAGO

REPRESENTED IN CANADA BY CANADIAN ELEVATOR EQUIPMENT CO. LTD., TORONTO

Machinery for the Wire Industry

SYNCRO

National Defense Developments

Prepared by

The Advisory Commission to the Council of National Defense

No Serious Shortage of Aluminum for Military Purposes

COMMENTING upon reports of alleged shortages in aluminum supplies, such as strong alloy sheet, extrusions, tubing, castings, and forgings for aircraft production in the National Defense program, the Commissioner in charge of the Industrial Materials Division recently stated:

✦ ✦ ✦

"INVESTIGATIONS just completed disclosed no serious shortages in aluminum supplies for aircraft and other military items now required for national defense. Certain temporary delays in delivery will doubtless occur under the rapid and unprecedented expansion demanded by the defense effort. New construction, however, is under way to increase fabricating facilities sufficiently in advance of plant increases in aircraft production to meet all military requirements. This expansion will increase capacity in the various branches of the aluminum industry from two to five times that of September, 1940.

✦ ✦ ✦

"THE Aluminum Company of America, the Reynolds Metals Company, and other fabricators are increasing their facilities for making strong alloy sheet, extrusions, tubing, rolled products, and the basic metal in ingot form.

✦ ✦ ✦

"IN the last 3 months, forge-hammer capacity has been increased 36 percent. An additional 94 percent increase is scheduled to come into operation during January and February of the current year. In addition to these hammers, negotiations are now under way with various automobile manufacturers and other producers throughout the country for further additions to hammer capacity.

✦ ✦ ✦

Alloy Sheet Mill Capacity

"STRONG alloy sheet mill capacity, now roughly 8,000,000 pounds per month, is scheduled to increase to 12,500,000 pounds per month in March 1941, 15,000,000 pounds per month in August 1941, and 22,500,000 pounds per month in June 1942. These increases, resulting from expansion programs of both the Reynolds Metals Company and the Aluminum Company of America, are expected to provide a monthly capacity in excess of total monthly requirements, in-

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

HIGH SPEED TUBULAR STRANDING HEADS — TYPE "TH"

SIX SECOND STOPS

HEAVY BOX BASE

DOUBLE LATCHED STEEL BOAT CRADLES

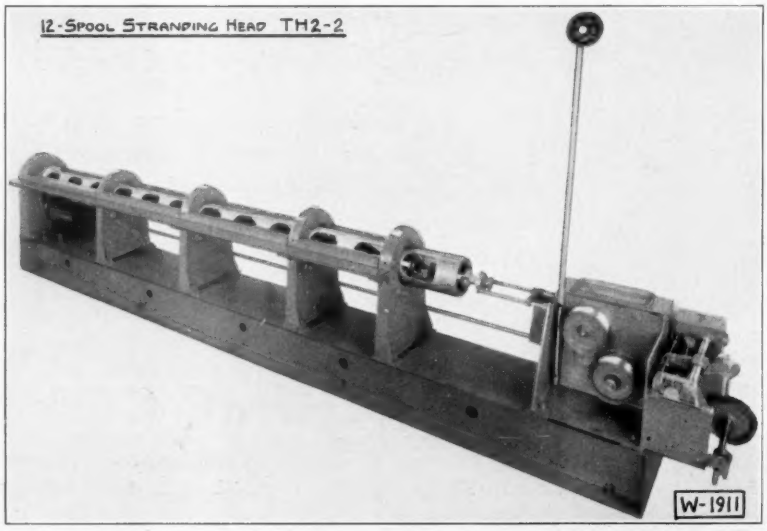
STEEL SPIDERS

ALL BALL BEARING

TUNGSTEN CARBIDE GUIDES

LOW WIRE ANGLES

DOUBLE GROOVED CAPSTANS



3" 4½" 8" 10" 12" 16" 22" 24" & 30" SPOOL SIZES

cluding civilian requirements at 1940 levels. Similar stops are under way to provide adequate capacity for extrusions and other fabricated aluminum items.

✦ ✦ ✦

"SINCE September, 1940, shipments of aluminum materials have been made to aircraft manufacturing companies in amounts considerably in excess of those necessary to meet current total military aircraft delivery schedules.

✦ ✦ ✦

"ON the basis of our investigation," the Commissioner pointed out, "several reports of shortages appear to have arisen mainly from fear of failure of future deliveries. This fear may be attributable to lack of general understanding as to the scope of construction which the National Defense Advisory Commission is now in a position to announce as under way."

✦ ✦ ✦

Pamphlet Describes Functions and Duties of Commission

IN response to numerous requests, the Commission has released a pamphlet describing its functions and duties and the part it is taking in the National Defense Program.

✦ ✦ ✦

THE first section of "The National Defense Advisory Commission: Duties and Functions" gives brief definitions of the duties of each of the seven Commissioners, of the duties of the Defense Housing Coordinator, of the Coordinator of National Defense Purchases, of the Administrator of Export Control, of the Coordinator of Commercial and Cultural Relations between the American Republics, and of the Division of State and Local Cooperation.

✦ ✦ ✦

THE second section is a division-by-division summary of the Commission activities since it was established on May 28, 1940, with a breakdown of the major contract categories, the amounts of each of the major defense items contracted for, and present deliveries on these items.

New English-Spanish Technical Dictionary

THE publication of a Comprehensive English-Spanish Technical Dictionary has been announced by **Lewis L. Sell**, Ph.D., Technical Translation Bureau, 15 Park Row, New York, N. Y.

✦ ✦ ✦

THE Dictionary will be published in sections of forty-eight printed pages, each section containing about 12,000 English and Spanish technical expressions and a set will be published approximately every four weeks until the work is completed. It is expected that it will take about thirty complete sets of forty-eight pages each to complete the work.

✦ ✦ ✦

DETAILED information can be obtained by addressing the publisher.

This is an invitation for you to become a member of The Wire Association. ✦ ✦ ✦ ✦ ✦ ✦

The Annual Dues Are $10.00

WHAT IS THE KESTER SOLDER-PRESCRIPTION SERVICE?

Here is a sound approach to a basic production problem—one that may be causing difficulty in your business right now!

The problem is to find the right solder for each metal-joining operation.

This means the solder alloy must be right for the metals or alloys with which it unites; the solder-flux must be the right type, right strength and right amount to clean the work thoroughly without damaging it; and, finally, the solder strand-size and core-size must be conveniently proportioned for easy handling.

These four elements, underscored above, must be scientifically determined by someone who knows the answers. The men who operate the Kester Solder-Prescription Service are qualified. They draw on 44 years of soldering experience. At their disposal are:

100 different solder alloys
10 different solder fluxes
80 different solder strand sizes
4 different solder core sizes

The combinations are almost endless — so if you're after the best possible soldering results, let Kester prescribe the solders.

Mail a detailed description of your metal-working problems to the address below, and you will promptly receive your Kester Solder-Prescription.

You incur no obligation in making use of this service.

* The Symbol of Kester Solder-Prescription Service

KESTER SOLDER CO.

4258 Wrightwood Avenue Chicago, Illinois
Eastern Plant: Newark, N. J.
Canadian Plant: Brantford, Ont.

KESTER CORED SOLDERS
STANDARD FOR INDUSTRY

The Platinum Metals in 1940

By Charles Engelhard, President, Baker & Company, Inc.

THE disorganized state of the world's markets and governmental restrictions on the publication of statistics make it difficult to estimate the world production and consumption of the platinum metals in 1940. However, facts concerning the United States market are known.

THE demand for platinum and platinum-clad products by the chemical and allied industries in the United States has been favorable during 1940.

✦ ✦ ✦

IN the jewelry and related fields the demand has followed the improved trend of those markets. While such demand, on the whole, was satisfactory, increased activity is looked for during the coming year.

THE market in the United States for palladium for dental use and for electrical requirements continued to expand. In the jewelry field, its use, in combination with yellow gold, has increased.

✦ ✦ ✦

ACTIVE markets were experienced for rhodium and iridium, the former in the chemical and electroplating industries, and the latter in the jewelry and electrical fields. During the year there developed a shortage of iridium. Ruthenium, as a hardener of platinum, is effectively used as a substitute for iridium and is much lower in cost.

✦ ✦ ✦

ASIDE from iridium, prices for the platinum metals have remained relatively stable during 1940. The price of platinum has held steady at between $36 and $38 per ounce. Iridium was quoted at $175 an ounce at the beginning of the year and declined to $125 in September. Increased demand from industry and from the jewelry field resulted in higher prices for iridium during the final quarter, and toward the year-end it was quoted in excess of $275 an ounce. At $24 an ounce, the price prevailing since 1935, palladium continued unchanged. Rhodium remained unaltered at $125 per ounce, the same as it has been since 1937. No change occurred in the price of ruthenium, which since 1938, has been quoted at $35 to $40 an ounce.

✦ ✦ ✦

Chemical Industry

THERE was increased interest in platinum and platinum-clad metal for use in the chemical and its allied industries. Special problems of corrosion are constantly arising in these fields and they can only be met by the platinum group of metals. Other problems involve the production of new materials in platinum-lined vessels or equipment built for the purpose. While some of the equipment under consideration is large, industry is finding that platinum, unlike many other materials, has good value when reclaimed.

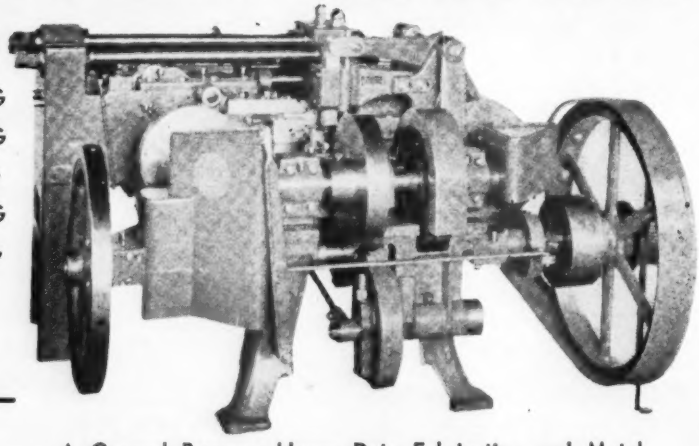
✦ ✦ ✦

A NEW platinum catalyst for the production of sulphuric acid has been developed by one of the foremost platinum refiners.

NILSON

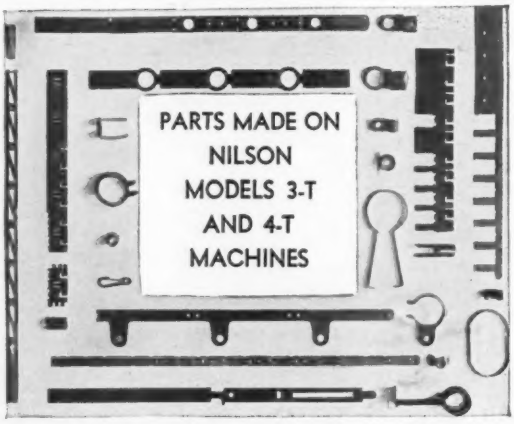
AUTOMATIC PRESS AND FOUR SLIDE MACHINE

FOR SWAGING STAMPING PIERCING BLANKING FORMING OF COILED METAL



A General Purpose, Heavy Duty Fabricating and Metal Forming Machine.

WE Build machines for forming Paper Clips, Buckles, Gate Hooks, Coat and Hat Hooks, Ceiling Hooks, Wire Ears, Cable Rings, Screw Eyes, Sash Chains, Automobile Side Chains, Flat Open Link Chains, Staples, Cotter Pins, Hose Clamps, Etc. and Wire Straighteners, Wire Reels, Frame Bending Machines and Special Presses.



▲▲▲

For Complete Details Address —

THE A. H. NILSON MACHINE CO.

BRIDGEPORT, CONN., U. S. A.

Operating experimental installations have been made of the new catalyst during the year, and favorable reports have been received of its efficiency as compared with other catalysts of competitive products. It is felt that this new catalyst will add to the position of platinum in the sulphuric acid industry.

✦ ✦ ✦

GREATER interest is being shown in palladium as a catalyst. In hydrogenation, especially of organic compounds, palladium or its salts can be used more efficiently and at lower temperatures and lower pressures than base metal catalysts.

✦ ✦ ✦

WITH the expansion in the United States of the facilities for the production of nitric acid, there has been a large demand for platinum-rhodium in the form of gauze for ammonia oxidation.

✦ ✦ ✦

Electrical Field

PALLADIUM in telephone relays and other types of electrical contacts found an improved market in the electrical field. Here pure palladium was used or palladium alloyed with silver.

✦ ✦ ✦

Aviation Industry

IN airplanes, platinum-iridium and platinum-ruthenium continue to be used for magneto points. Experiments continue with the use of platinum-iridium and platinum-rhodium for spark plugs in airplane engines, as well as in spark plugs for semi-Diesel engine operation.

✦ ✦ ✦

Optical Field

FURTHER progress was made in the production and marketing of platinum-clad-nickel optical frames, a product having the advantage of a platinum covering as compared with the usual 12-karat gold covering, and having the universal sales appeal of platinum.

✦ ✦ ✦

Forecast

WITH the contemplated industrial development of the United States during the coming year, further expansion of all of the markets for platinum metals is anticipated.

Cleveland Tramrail Announces New Booklet

A NEW booklet has been prepared as an informative piece of literature for those interested in the overhead method of materials handling. Herein is featured a variety of grabs and handling devices for many kinds of materials.

✦ ✦ ✦

WHILE many of the grabs can be used with other make systems, they are being offered to users of Cleveland Tramrail only. Obviously most grabs are relatively minor parts of a Tramrail System. Motor-driven grabs, of course, are major items, but in most instances these have been designed for use exclusively on Cleveland Tramrail.

✦ ✦ ✦

IT is felt that if this material suggests new ideas for more efficient materials handling and stimulates the further use of the overhead method, this booklet has served its purpose.

✦ ✦ ✦

A COPY of the booklet may be obtained by addressing the Cleveland Tramrail Division of the Cleveland Crane & Engineering Company, Wickliffe, Ohio.

Bulletin 241
shows many installations
IN IMPORTANT INDUSTRIES

The ability of any company can be accurately judged by the calibre of customers it keeps on its repeat order list.

We are proud to be serving . . . repeatedly . . . many of the nations leading industries.

Write Today
Over 20 Years' Experience

Industrial
OVENS
ROD BAKERS
Industrial
FURNACES
WELDING ROD
OVENS

The CARL-MAYER Corp.
3030 Euclid Ave., CLEVELAND, OHIO.

Stainless Sprayed Reconditioned Parts Give Up to 3 Times Original Life

SPRAYING worn parts with stainless steel by a metallizing process and re-machining to size, is producing reconditioned parts giving from 100 to 300 per cent their original service life on a well-known Middle Western Railroad.

✦ ✦ ✦

MANY locomotive parts which would normally be scrapped are being reclaimed and reconditioned by this process—as well as such parts as shafts, water pump piston rods, motor armature shafts, etc.

✦ ✦ ✦

IN practice, 18-8 stainless steel for metallizing, in wire form, is fed into the back of a gun equipped with an air turbine supplying power to two knurled rolls—feeding the wire through the gun into the center of a neutral oxy-acetylene flame. By careful adjustment of the speed of the wire through this flame, a fine atomization and even deposition on the worn parts are obtained.

✦ ✦ ✦

PRIOR to the spraying, all surfaces to be sprayed are sand blasted, using a 30 mesh steel angular grit, which not only thoroughly cleans, but also roughens the surface and enables the sprayed metal to adhere to it. Spraying is to a depth of 1/64th to 1/32nd in. per side in excess of the size to which the part is to be machined.

✦ ✦ ✦

TO obtain the fine finish desired, it was found desirable to turn such sprayed metal finishes at high speeds—from 200 to 450 ft. per minute—with fine cuts and a slow feed. For turning operations, Carboloy tools are therefore used. On parts that cannot be turned, the surfaces are finished by grinding from the rough.

✦ ✦ ✦

Spot and Projection Welders

A COMPLETE line of direct action air operated Press Type Spot and Projection Welders is announced by the **Acme Electric Welder Company,** 5621 Pacific Blvd., Huntington Park, Calif.

✦ ✦ ✦

THIS line of air operated spot welders is manufactured in transformer capacities from 30 KVA to 150 KVA. In the smaller capacity welders throat depths are available from 12″ to 30″, and in the larger capacity welders from 12″ to 48″. Eight steps of heat regulation are standard but up to 32 steps can be supplied on special order.

✦ ✦ ✦

THE all-welded fabricated steel construction of the welder bases not only provides extreme rigidity and sturdiness, but a particularly modern and streamlined appearance.

✦ ✦ ✦

OTHER standard features include watercooling of secondary, column and electrodes, universal double end reversible horns, positive locking type heat regulating switch, piston packed mirror ground air cylinder cushioned on both up and down stroke, and complete air equipment including air filter.

All-Metal WIRE SPOOLS

CABLE SPOOLS . . . *for Insulated and Rubber Covered Wire, Solder, and similar products.*

These spool ends are formed from cold rolled steel of gauges to meet specific demands for strength. The edges are curled and ribs embossed for increased rigidity. Panels may be worked into your design and embossed, for use in marking size and variety. All parts are lithographed for identification purposes and to protect the metal.

Ends and traverses may be shipped unassembled. A simple operation on a hand, foot, or power press makes rigid and permanent assembly.

Made in 5″, 6½″ and 10½″ diameter Ends; Traverses 1 15/16″ diameter (or special 3½″ diameter for 10½″ End), in any desired lengths.

FINE WIRE SPOOLS . . . *for winding and shipping Fine, Steel, Copper, and Enameled Wires.*

Spools are formed from tin plate tested for maximum rigidity. Made with locked-seam barrel and one-piece ends, they are so assembled that there is no possibility of wire being trapped in the joint where barrel and end meet. Ends are made with full curl on edge, which provides additional strength and a smooth winding edge.

Entire spool may be finished with gold lacquer or a variety of colored lacquers; with or without identifying copy embossed in the ends.

Made in 2 7/16″ and 3″ diameter Ends. The 2 7/16″ size is made with 1½″ diameter Traverse only; the 3″ diameter with 1½″ or 1¾″ diameter Traverse.

We will send samples at your request.

J. L. CLARK MANUFACTURING CO.
600 23rd AVENUE • ROCKFORD, ILLINOIS

Vascoloy-Ramet Extends Facilities And Adds to Staff

IN line with their constant efforts to improve, not only their products, but to better their production, distribution and service facilities, the Vascoloy - Ramet Corporation, Fansteel Metallurgical Corporation and the Vanadium Alloys Steel Company have been expanding their staff.

✦ ✦ ✦

PROCESSES of refining basic rare metal ores into carbide powders having uniform physical structure and purity characteristics have been extended so that work formerly taking days has been developed to the point where the time consumed is a matter of hours.

✦ ✦ ✦

THE manufacture of carbide powders into blanks for dies and cutting tools has been facilitated and speeded by the development and installation of modern equipment, some of which involves exclusive processes and machines, with many departments operating at the present time on a twenty-four hour basis.

✦ ✦ ✦

PREVIOUSLY sold and serviced through district offices of the Vanadium Alloy Steel Company and authorized agencies, Vascoloy-Ramet die blanks and tools will hereafter also be sold and serviced through a sales engineering staff under the direct management of the Vascoloy-Ramet Corporation. In this connection factory owned branches have been established in Cleveland, Cincinnati, Detroit, Hartford, Jersey City, Philadelphia, Pittsburgh and Milwaukee.

✦ ✦ ✦

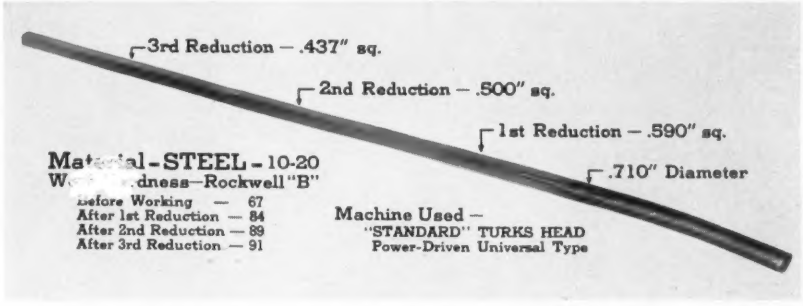
AMONG the carbide sales engineers transferred to the new Vascoloy-Ramet sales and service organization are: **Clarence J. Busch** and **Wilfred Pulver,** in Milwaukee; **C. W. Blade,** in Hartford; **F. B. Sturm,** in Detroit; and **John Lee** and **S. A. Miniea,** in North Chicago. **Herbert B. Clark** and **James A. Fraser** will continue to serve as sales manager and assistant sales manager, respectively.

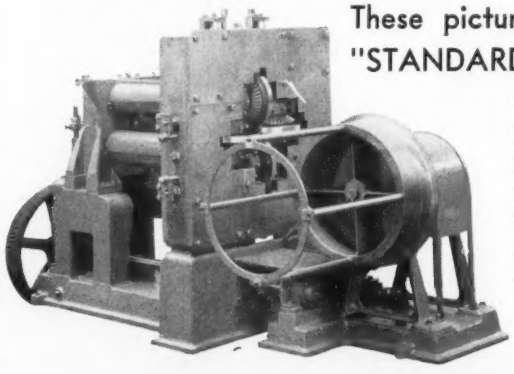
Geo. B. Kutz, District Sales Manager, Wright Manufacturing Div., American Chain & Cable

GEORGE B. KUTZ has been appointed district sales manager for the southeastern territory of the Wright Manufacturing Division of American Chain & Cable Co., Inc., of York, Pa. For several years he was district sales manager at Chicago for the American Chain Division, but recently has been located at York, Pa. It is expected that he will make his headquarters in Atlanta.

A. N. Swanson, Now Chief Metallurgist, Gary Works, Carnegie-Illinois Steel Corp.

THE appointment of **A. N. Swanson** as chief metallurgist of the Gary Works of the Carnegie-Illinois Steel Corporation has been announced. Mr. Swanson was first employed at Gary Works in 1922 in the metallurgical department where he served in various capacities until 1934 when he became assistant chief metallurgist. In 1940 he was appointed assistant to the division superintendent of the west mills.

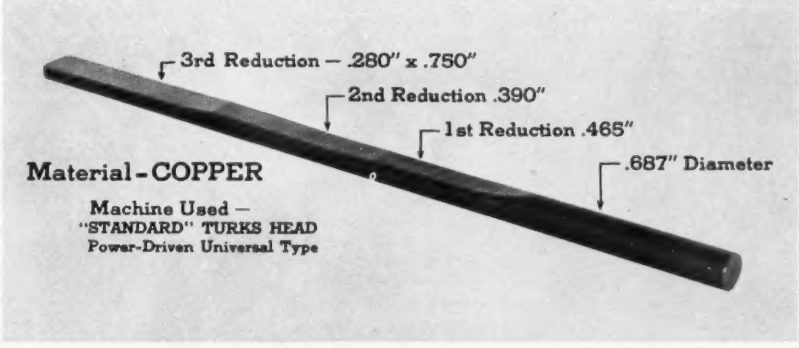

3rd Reduction — .437" sq.
2nd Reduction — .500" sq.
1st Reduction — .590" sq.
.710" Diameter
Material - STEEL - 10-20
Hardness—Rockwell "B"
Before Working — 67
After 1st Reduction — 84
After 2nd Reduction — 89
After 3rd Reduction — 91
Machine Used —
"STANDARD" TURKS HEAD
Power-Driven Universal Type



These pictures tell the "STANDARD" TURKS HEAD Story.

Above—10-20 carbon steel, .710" diameter reduced to .437" square with sharp corners in three passes; below, .687" diameter copper reduced to rectangular shape .280" x .750" in three passes.

Visualize this in terms of your own work, then write, stating your requirements (shape, stock, production, etc.), and we shall be glad to send specific recommendations including price and delivery.



Information also available about "Standard" Swaging Machines, Rolling Mills, Draw Benches, Drop Hammers and Presses. Address

IT'S **STANDARD** PRACTICE

MACHINERY COMPANY

PROVIDENCE, RHODE ISLAND

Magnus Announces New Appointments

MAGNUS Chemical Company, Inc., Garwood, N. J. manufacturers of Cleaning Materials, Industrial Soaps, Metallic Soaps, Emulsifying Agents and Metal Working Lubricants, announces four appointments as follows:

Paul Blanchard as sales representative in Scranton, Pa., and vicinity. **Henry W. Scott** becomes resident sales representative in southeastern Florida.

Walter E. Winship will represent Magnus in the State of Louisiana and southeastern Mississippi.

J. H. Welch as sales representative in Arkansas and the western part of Tennessee.

✦ ✦ ✦

New Type Tramrail Carrier Developed

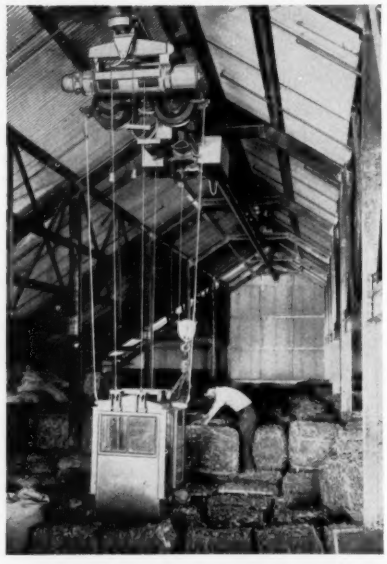
THE Cleveland Tramrail Division of The Cleveland Crane and Engineering Company, Wickliffe, Ohio, has developed a new type of Tramrail Carrier with raise-lower cab.

✦ ✦ ✦

THIS equipment is available in two general forms. One form provides for the raising and lowering of cab and load together. The other provides for the cab and load raising and lowering independently of each other. Which type to use is contingent upon the service and materials to be handled.

✦ ✦ ✦

WITH a raise-lower cab unit one operator may take care



of all operations involved in moving materials with an electric cab-controlled overhead Tramrail system: attaching load to crane hook, detaching, and operation of the Tramrail unit. If the materials are of such nature that a lifting fork need be employed, one operator can also handle the entire job just as with a crane hook.

✦ ✦ ✦

THE unit illustrated handles unwieldy loads of cork. The cab and load hook are operated independently of each other. During the day shift when large quantities of cork are required to keep up the production, the cab is kept in the upper position firmly attached to the Tramrail carrier. Three

WIRE QUALITY... PLANT PRODUCTION *Stepped Up* WITH TECO *Carbide* DIES

You increase efficiency all down the line when wire drawing is entrusted to TECO Carbide Dies. TECO draws not only more wire tonnage per die, but finer *finished* wire! And that's only the start of the story! Add to your profits from stepped-up production the economy of TECO's dependable, long-life performance. You have fewer plant interruptions with TECO Carbide Dies, fewer wire rejects, less delay for die changing and refinishing. TECO is a hard, tough carbide composition, even and exceptionally slow to wear! It gives wire a high polish, smooth, uniform finish.

It will pay you to investigate the many money-saving, money *making* advantages of TECO Carbide Dies. A Tungsten Electric engineer will be glad to discuss with you your wire drawing problems and show you in your own plant how TECO Dies lower drawing costs and increase production. Why not consult us today?

Pioneers of Tungsten Carbide for over a Quarter of a Century

Never Say Die—always specify
TECO CARBIDE DIES
for *smooth* wire drawing--they last longer!

Tungsten Electric supplies carbide blanks, tools and bits. Wire and bar dies, tubing, extruding and sizing dies. Also, special tools, such as spot facers, reamers, broaches, form tools, etc.

TECO
TUNGSTEN ELECTRIC CORPORATION
564 – 39th ST. • UNION CITY, N. J.
Branch Office: 2900 Euclid Ave., Cleveland, O.

WIRE WISDOM

Just a little RODINE in the pickling bath saves acid and metal, minimizes brittleness, lowers pickling costs. RODINE more than pays its way.

CUPRODINE creates a denser, tighter, brighter and more uniform copper coating, in less time. Provides better lubrication for drawing than ordinary coating.

Write for details.

American Chemical Paint Co.

Main Office and Factory

AMBLER, PENNA.

IMMEDIATE RECOGNITION!
ACCORDED THIS FOUR-STAR BOOK

★ Practical ★ Original ★ Interesting ★ Complete

From all quarters has come commendation of this latest ASM book on practical metallurgy. Already four famous engineering schools—Case School of Applied Science . . . University of Wisconsin . . . Brooklyn Polytechnic Institute . . . Stevens Institute of Technology — are planning to use this book as a textbook for their courses in metallurgy.

Typical of other responses is that from Dr. Zay Jeffries, General Electric authority, who says: "The book constitutes a valuable addition to the literature of metallurgy".

If you haven't ordered your copy, do so today. You'll agree when you receive "Practical Metallurgy" that this is the finest book on this subject available today.

PRACTICAL METALLURGY

Applied Physical Metallurgy — Industrial Processing of Ferrous and Nonferrous Metals and Alloys

by

GEORGE SACHS,
Case School of Applied Science
and
KENT R. VAN HORN,
Aluminum Company of America

570 Pages . . . 355 Illustrations . . . 6x9 . . . Red Cloth Bound

$5.00

In addition to 335 general illustrations, PRACTICAL METALLURGY contains 160 constitutional diagrams covering all systems that contain an important commercial alloy. These diagrams . . . the chapters on Plastic Deformation of Ferrous and Nonferrous Metals . . . and the chapter on Internal Stress in Metals contain information not available in any other book published in this country.

Here is the book you've long wanted — a simple yet complete treatise on practical metallurgy.

WIRE & WIRE PRODUCTS
300 Main Street Stamford, Conn.

men are then employed; one for attaching loads, one for detaching at receiving end, and the third for operation of the Tramrail unit. During the night shift when the demands for materials are not so great, the cab operator alone, through use of the raise-lower cab, takes care of the entire job.

✦ ✦ ✦

THE unit shown has a vertical travel of 40 feet for both cab and hook. Equipment can be furnished for operation from much greater heighths if desirable. The load hoist, the cab hoist and the carrier are all motorized and controlled from the cab. This particular unit is so arranged that it cannot be traveled until the cab is in the high position.

✦ ✦ ✦

FOR handling heavy kegs, sacks, etc., in and out of a stockroom or warehouse, the use of a lifting fork and pallets often provides the best and most efficient means. The fork may be connected to the cab, so that both move together, thus enabling the operator to always be abreast of the load—not above or below at any time.

✦ ✦ ✦

HE then has no difficulty threading the fork under the pallets of materials, as is so often the case with other types of equipment which keep him at a distance of 10 to 15 feet (either above or below) from the work and prevent him getting a proper view.

✦ ✦ ✦

TRAMRAIL units having cab connected to lifting fork or other similar material handling devices, are generally arranged so that they may be traveled even when cab is suspended at a considerable distance below the carrier. This enables the operator to steer his lifting fork into or away from the load on the floor or on top of a high pile with precision and as the situation demands.

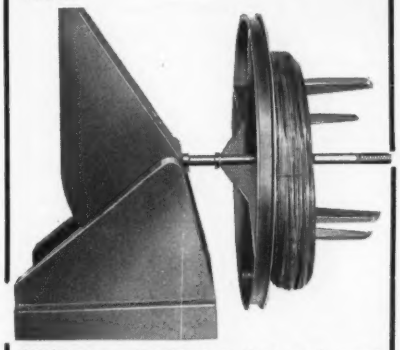
✦ ✦ ✦

A SALIENT advantage of Cleveland Tramrail raise-lower cab carriers is their great aid to safety. With their use, piling height is not limited and the operator is just as safe 60 feet above the floor as 10 feet. The danger of heavy kegs and other materials falling on him

(*Please turn to Page 140*)

THE "SHIFTWEIGHT" TILTING WIRE REEL

A counter-balanced tilting wire reel with full 42" diameter upper guard rings, allowing perfect feeding of wire off the coil and absolutely "Snarl Proof."



Weight so distributed that reel need not be bolted to floor.

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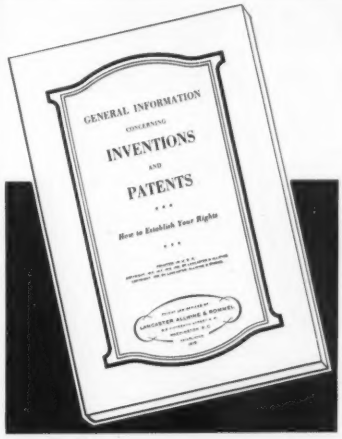

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GET THE FACTS

Ask for performance data from mills producing wire similar to yours and see what these compounds are achieving in service.

MAGNUS CHEMICAL CO.
188 South Ave., Garwood, N. J.
MAGNUS CLEANERS

New Type Tramrail Carrier Developed

(*Continued from Page 139*)

from above is eliminated. The highest tier of the pile can be piled just as level and securely as the tier resting on the floor.

✦ ✦ ✦

CLEVELAND Tramrail raise-lower cab carriers are especially suitable for the economical handling of kegs, drums, rolls of paper and cloth, lumber, sheet steel, cement, cereals and a great many other products. They are available for operation at various heights and speeds as required.

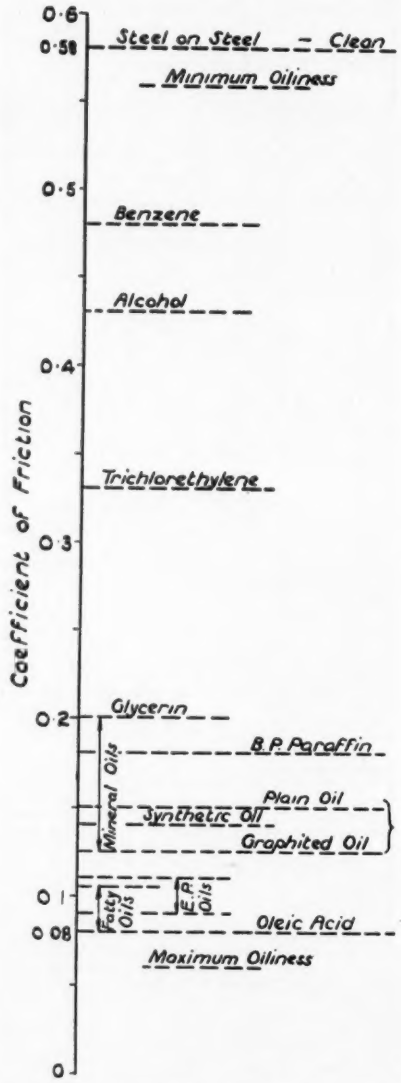
✦ ✦ ✦

Amthor Moves to Larger Quarters

THE Amthor Testing Instrument Co., Inc., have recently purchased their own two story factory building and are now located at 45-53 Van Sinderen Avenue, Brooklyn, N. Y. Larger and finer facilities now available will enable them to take care of a greater volume of business.

Study of Static Friction on Lubricated Surfaces

EVER since the development of the various testing machines for testing lubricating characteristics of oils, etc., under "boundary" conditions (absence of a continuous film), inconsistencies in



Coefficients of Friction of Various Lubricants Under Boundary Conditions

comparative test results have provided many a basis for argument.

✦ ✦ ✦

DETAILS of a study recently completed by the National Physical Laboratory in England

seem to indicate a possible reason for such inconsistencies.

✦ ✦ ✦

IN a broad study of static friction of lubricated surfaces, **A. Fogg,** M. Sc., and **S. A. Hunwicks,** B. Sc., discovered that surface adsorption of 'cleaning' materials by the surfaces being used for test introduced serious errors in test results.

✦ ✦ ✦

FOR instance, a steel surface with an original static coefficient of .58, when 'cleaned' with trichlorethylene showed a coefficient of from .33 to .45, the higher value representing vapour cleaning, while the lower coefficient resulted from cleaning the surface with trichlorethylene in liquid form.

✦ ✦ ✦

IN contrast, it was found that after 'cleaning' the surface with the finest grade of emery paper available (0000 blue black) the original coefficient of friction was restored, indicating that the sanding had removed the surface layer with the adsorbed contaminating material.

✦ ✦ ✦

AN even more pronounced effect on friction of adsorption of materials by the surface being lubricated was found when using oils containing colloidal Acheson graphite (as produced by Acheson Colloids Corporation in this country). When such oils were removed by flushing with benzene, the static friction of the surface remained identical as during the test with the oil present, indicating that the fine graphite particles had been adsorbed in the surface material — forming a 'graphoid' surface. As a check on this, the same type of oil without colloidal graphite was applied and flushed off with benzene, resulting in a much higher coefficient of friction. Apparently, therefore, the lack of change in the coefficient of friction was due to adsorption of graphite rather than oil.

✦ ✦ ✦

A FURTHER confirmation of the formation of a graphoid 'dry-lubricating' surface was obtained by covering the surfaces again with untreated oil. Under this condition, the static coefficient of friction was identical with that of the former treated oil, rather than the higher value for the untreated oil.

✦ ✦ ✦

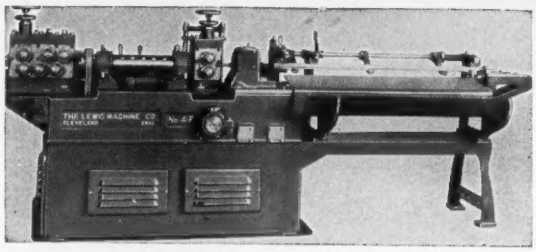
CONCLUSIONS drawn from the extensive series of tests by Messrs. Fogg and Hunwicks included the following:

1. **Lubricating qualities in the boundary condition are relatively independent of viscosity of the lubricant.**
2. **Lowest coefficients of friction are obtained with fatty oils, followed by E.P. lubricants, graphited oils, and mineral oils, in that order.**

INCLUDED in the tests was a short investigation as to whether an E.P. lubricant leaves a surface layer which is in itself an effective lubrication—as was found to be the case with graphited oils. On cleaning the surface with trychlorethylene vapour after be-

(*Please turn to Page 143*)

LEWIS TRAVEL-CUT WIRE STRAIGHTENING and CUTTING Machines



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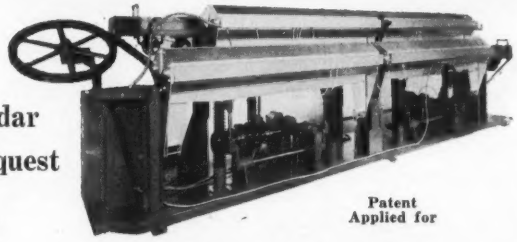

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OAKITE CERTIFIED CLEANING
MATERIALS METHODS SERVICE

New Cold Strip Mill for High Precision Rolling of Non-Ferrous Metals

HEAVY design and construction of high strength materials, to meet the requirements of sustained operation at high speeds with heavy passes, feature this 20"x32" Two-High Cold Strip Mill recently built by Farrel-Birmingham Company, Inc., Ansonia, Conn., for high precision rolling of aluminum, aluminum alloys, duralumin and other non-ferrous metals.

✦ ✦ ✦

FORGED tool steel rolls, heat-treated, hardened and precisely ground with a high finish, are carried in precision type, flood-lubricated sleeve bearings.

✦ ✦ ✦

THE rolls and mill pinions are connected by universal spindles, designed to eliminate shock, looseness and end thrust between the pinion stand and the rolls.

✦ ✦ ✦

THE mill housings are of the arch-top type, made of cast steel. They are of large section to provide the strength necessary for the work to be performed. The bases of the screwdown housings are cast integrally with the mill housings. The mill housings are carried on heavy stringer bedplates and at the top are securely bolted together by a cast steel stretcher, on which is mounted the screwdown lubricating pump.

✦ ✦ ✦

Built-in Screwdown

THE double motor screwdown built into the housings, provides ease of manipulation and facilitates setting the rolls with extreme accuracy, an important factor in the type of work for which the mill is designed. Adjustment can be made against the metal while the mill is in operation.

Separate operation of each screw or the synchronization of both, when both ends of the roll are to be adjusted together, is provided by a magnetic clutch connecting the two screwdown motors. The screwdown gearing is fully enclosed and is lubricated by a continuous circulating system.

✦ ✦ ✦

Constant Tension Reels

ON the entry and delivery sides of the mill are mounted collapsible block reels. Each reel consists of a collapsible, air-operated drum provided with a gripping jaw to facilitate starting the metal around the drum. Reel drums are carried on the low-speed shaft extensions of the enclosed gear reduction drives, without outboard bearings. Each complete reel unit is mounted on a Meehanite bedplate. The reels are driven by direct current motors, interconnected with the main mill motor. The reels are the constant tension type, designed to provide constant tension from empty to full reel, to keep the metal straight and flat and maintain uniform gauge.

✦ ✦ ✦

Combined Reduction Drive and Pinion Stand

THE mill is driven by a direct-current, variable speed motor, through an enclosed double reduction drive with integral pinion stand. The reduction drive is the heavy duty rolling mill type of gear unit with all gear centers in the same horizontal plane. Gears and mill pinions are of alloy steel with continuous herringbone teeth accurately generated by the Sykes process. All shafts are mounted in anti-friction roller bearings. Drive and pinion stand housing is cast Meehanite. A built-in oil pump, equipped with filter, driven from the high speed shaft of the gear unit provides spray lubrication of the gear teeth and flood lubrication of the bearings. A Farrel Gearflex Coupling connects the motor and drive.

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The Annual Dues are $10.00
✦ ✦ ✦
The 1941 Convention will be held in October at Philadelphia, Pa.
✦ ✦ ✦
For Details Address
Richard E. Brown, Secretary
The Wire Association
300 Main St. Stamford, Conn.
Stamford Trust Co. Bldg.

Study of Static Friction on Lubricated Surfaces

(*Continued from Page 141*)

ing covered overnight with an E.P. lubricant, the coefficient of friction was found to be identical with that obtained by degreasing any conventional oil-contaminated surface. The investigators reason therefore, that if any action does take place between an extreme pressure oil and a metal surface, resulting in a new surface layer, this layer has no separate influence on friction.

✦ ✦ ✦

Harry L. Erlicher, Vice President, General Electric Company

HARRY L. ERLICHER, purchasing agent of General Electric since 1931 and an employee of the company 40 years, was elected a vice president at a meeting of the board of directors in New York. He will continue to be in charge of the company's purchasing activities.

✦ ✦ ✦

MR. ERLICHER'S first job with General Electric was as a messenger boy. He was 14 years of age at that time. Purchasing interested him and when he was advanced to office boy he asked if he might be assigned to the purchasing department. He did not remain long as office boy and soon was given a clerical position. In 1910 he was named a buyer, in 1923 was promoted to assistant purchasing agent and in 1931 was named general purchasing agent, when L. G. Banker retired.

✦ ✦ ✦

L. E. Smith, Chief Engr., Kokomo Plant, Continental Steel Corp.

L. E. SMITH, formerly superintendent of masonry for the Continental Steel Corporation, Kokomo, Indiana has been appointed chief engineer of the company's Kokomo Plant, succeeding **L. H. Mandeville,** resigned. The appointment became effective January 15.

✦ ✦ ✦

MR. SMITH has been connected with the company for the past six years. He graduated from Purdue University in 1925.

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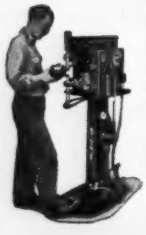
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the original Frank Mossberg Co.
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Attleboro, Mass.

Uses of Nickel for Wire and Wire Products

IN a recent annual review, **Robert C. Stanley**, Chairman and President of the International Nickel Company, called attention among other things to the various uses of nickel for wire and wire products. Among them were the following:

✦ ✦ ✦

HIGH carbon nickel-molybdenum steel promises to effect a considerable improvement over materials now in common use for coil and leaf springs.

✦ ✦ ✦

Z-NICKEL is expanding in use for electrical applications, and for springs, where its mechanical properties, particularly fatigue resistance, are important factors.

✦ ✦ ✦

NICKEL-chromium and nickel-chromium-iron alloys for electrical-resistance wire are being used in large quantities. Alloys of 32-42% nickel iron continue to be employed in the low-expansion side of bi-metal for thermostatic work and have been utilized during the year 1940 in a new type of thermometer. For the high expansion part of bi-metal devices, a 22% nickel alloy is being increasingly used.

✦ ✦ ✦

INCREASED hardness requirements on back-up rolls have rendered unsatisfactory the steels commonly used in the past, and high carbon nickel-chromium-molybdenum steels are therefore being adopted to an increasing extent for this application. A medium carbon steel of this type, machined after treatment to 350 Brinell hardness, is now employed for heavy duty gears and pinions in rolling mills by one of the leading builders of such equipment. The ability to meet high strength requirements in gears too large to liquid-quench has resulted in adoption of this same steel, with a simple normalizing treatment.

✦ ✦ ✦

LARGE cast steel pinions of 3% nickel-molybdenum steel have broken all records for long service in a leading Pennsylvania mill.

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Insulating Machinery for Western Electric Continuous Vulcanizing process.
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Index to Advertisers

A

American Chemical Paint Co. 139
American Insulating Machinery Co. 141
American Lanolin Co. 140
Apco-Mossberg Co. 144

B

Bethlehem Steel Co. 98
Broden Construction Co. 144

C

Callite Tungsten Corp. 130
Carboloy Company, Inc. 97
Carl-Mayer Corp., The 135
Clark, J. L., Mfg. Co. 136
Cleveland Tramrail Div. of Cleveland Crane & Eng. Co. 143
Cochaud Wire Die Corp. 142
Crepe-Kraft Co., Inc., The 144

D

Davis, R. L., Electric Co. 144
Drever Co., The ..... Inside Front Cover
Durant Mfg. Co. 144

E

Eisler Engineering Co., Inc. 144
Electric Furnace Co., The ..... Back Cover
Entwistle, Jas. L. 144

F

Farrel-Birmingham Co. 143
Fidelity Machine Co. 144
Firth-Sterling Steel Co. 108
Fort Wayne Wire Die, Inc. 142

G

Glader, Wm., Machine Works 129

H

Hallden Machine Co., The 143
Hartley, Geo. D. 143
Hubbard Spool Co. 143
Hudson Wire Co. ..... Inside Back Cover

J

Jones & Laughlin Steel Corp. ..... Front Cover

K

Kelly Wire Die Corp. 142
Kester Solder Co. 133
Keystone Steel & Wire Co. 127
Krause, F. & Co., Inc. 142

L

Lancaster, Allwine & Rommel 139
Lewis, K. B. 143
Lewis Machine Co., The 141

M

Magnus Chemical Co. 140
Micro Products Corp. 126
Morgan Construction Co. 106
Moslo Machinery, Inc. 139
Mossberg Pressed Steel Corp. 143

N

National Annealing Box Co. 143
National Machinery Exchange 143
New England Butt Co. 143
Nilson, A. H., Machine Co. 134
Norton Company 105

O

Oakite Products, Inc. 141

P

Pittsburgh Steel Co. 100
Platt Brothers & Co. 144

R

Robertson, John, Co., Inc. 128
Ross, J. O., Engineering Corp. Division of Ross Industries Corp. 143
Royle, John & Sons 144
Reusch, H. J., Machine Co. 144
Rusch Wire Die Corp. 142

S

Scott, H. L., Co. 144
Scudder, E. J., Foundry & Machine Co. 144
Shuster, F. B., Co., The 143
Sleeper & Hartley, Inc. 115
Standard Industrial Compounds Co. 140
Standard Machinery Co. 137
Stevens Metal Products Co. 107
Surface Combustion Corp. 144
Syncro Machine Co. 131

T

Terkelsen Machine Co. 144
Thomson-Judd Wire Machy. Co. 144
Torrington Manufacturing Co. 99
Tungsten Electric Corp. 138

V

Vascoloy-Ramet Corp. 102
Vaughn Machinery Co. 103
Vianney Wire Die Works 142

W

Waterbury Farrel Fdry. & Mach. Co. 101
Watson Machine Co. 132
Wayne Wire Die Co. 142

WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Directory, Index & Buyers' Guide.

ABRASIVES—
Norton Co., Worcester, Mass.

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Farrel-Birmingham Co., Inc., Ansonia, Conn.

AIR DRAW FURNACES—
Carl-Mayer Corp., The, Cleveland, Ohio.

ANNEALING MACHINES—Open Flame
Drever, Co., The, Philadelphia, Pa.
Syncro Machine Co., Rahway, N. J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.

ANTI-RUST—Compound
Magnus Chemical Co., Garwood, N. J.

ARMORING EQUIPMENT—
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

AUTOMATIC SPARK TESTING EQUIPMENT—
Entwistle, James L., Pawtucket, R. I.

BAKERS—Hi-Speed
Carl-Mayer Corp., The, Cleveland, Ohio.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Moslo Machinery, Inc., Cleveland, O.
Ross, J. O., Engineering Corp., New York, N. Y.

BANBURY MIXERS—
Farrel-Birmingham Co., Inc., Ansonia, Conn.

BERYLLIUM COPPER—Strip and Bars
Callite Tungsten Corp., Union City, N. J.

BLOCKERS—
Farrel-Birmingham Co., Inc., Ansonia, Conn.

BOBBINS—Braider and Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

BORON CARBIDE—
Norton Co., Worcester, Mass.

CALIPERS—Roll
Farrel-Birmingham Co., Inc., Ansonia, Conn.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CASTINGS—Wire Mill
Farrel-Birmingham Co., Inc., Ansonia, Conn.

CEMENT FLOOR CLEANER—
Magnus Chemical Co., Garwood, N. J.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Magnus Chemical Co., Garwood, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANERS—Hand and Metal
Magnus Chemical Co., Garwood, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIPMENT—
Broden Construction Co., Cleveland, O.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Lee Wilson Engineering Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CLOTH TESTERS—
Scott, Henry L., Co., Providence, R. I.

CLOTH—Wire, All Metals
Callite Tungsten Corp., Union City, N. J.

COATING—Protective
American Lanolin Corp., Lawrence, Mass.

COILERS—Sheet, Strip and Wire
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

COILERS AND SPOOLERS FOR INSULATED WIRES—
Entwistle, James L., Pawtucket, R. I.

COLD HEADERS—
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

COMPOUNDS—Wire Drawing
Magnus Chemical Co., Garwood, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

WHERE TO BUY, Continued

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

DIAMONDS—Industrial
Callite Tungsten Corp., Union City, N. J.

DIAMOND POWDERS—
Rusch Wire Die Corp., New York, N. Y.

DIAMOND TOOLS—
Rusch Wire Die Corp., New York, N. Y.

DIES—Diamond
Cochaud Wire Die Co., New York, N. Y.
Fort Wayne Wire Die, Inc., Fort Wayne, Indiana
Kelly Wire Die Corp., New York, N. Y.
Krause, F., & Co., Inc., Jersey City, N. J.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Jersey City, N. J.

DIES—Lead Extrusion
Robertson, John, Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Carboloy Co., Inc., Detroit, Mich.
Cochaud Wire Die Co., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Fort Wayne Wire Die, Inc., Fort Wayne, Indiana
Kelly Wire Die Corp., New York, N. Y.
Krause, F., & Co., Inc., Jersey City, N. J.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Jersey City, N. J.

DIES—Rod and Tube Drawing
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.

DIES—Tantalum Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.

DIES—Tungsten Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Stevens Metal Products Co., Niles, O.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

ENGINEERS—Consulting Wire Mill
Hartley, George D., Worcester, Mass.
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Insulation Testing
Davis, R. L., Electric Co., Wallingford, Conn.
Entwistle, James L., Pawtucket, R. I.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FLASH BAKER—
Carl-Mayer Corp., The, Cleveland, Ohio

FURNACES—Annealing
Carl-Mayer Corp., The, Cleveland, Ohio.
Drever, Co., The, Philadelphia, Pa.
Electric Furnace Co., Salem, O.
Lee Wilson Engineering Co., Cleveland, Ohio
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Lee Wilson Engineering Co., Cleveland, Ohio
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, O.
Firth-Sterling Steel Co., McKeesport, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.
Lee Wilson Engineering Co., Cleveland, Ohio
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Electric
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Hardening and Tempering
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, O.
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Salt Bath
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Lee Wilson Engineering Co., Cleveland, Ohio
Surface Combustion Corp., Toledo, Ohio.

GALVANIZING EQUIPMENT—
Lee Wilson Engineering Co., Cleveland, Ohio

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GATES—Blast, For Low Pressure Air
Farrel-Birmingham Co., Inc., Ansonia, Conn.

GEARS—Continuous Tooth Herringbone
Farrel-Birmingham Co., Inc., Ansonia, Conn.

GEARS—Wire Mill
Farrel-Birmingham Co., Inc., Ansonia, Conn.

GRINDERS—Roll
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Norton Co., Worcester, Mass.

HI-SPEED BAKERS—
Carl-Mayer Corp., The,, Cleveland, Ohio.

HOISTS—Electric Travelling
Cleveland Tramrail div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

INHIBITORS—
American Chemical Paint Co., Ambler, Pa.

INSTRUMENTS—Electrical
Entwistle, James L., Pawtucket, R. I.

KETTLES—Galvanizing, Annealing, Tinning, etc.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LUBRICANTS—For Metal Cutting Cleaning, Stamping and Drawing
Magnus Chemical Co., Garwood, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Magnus Chemical Co., Garwood, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY — Armoring (Cable, Wire Hose)
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Robertson, John, Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.

MACHINERY—Bunching
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Mach'y. Co., Phila., Pa.
Entwistle, James L., Pawtucket, R. I.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Coilers
Broden Construction Co., Cleveland, O.
Entwistle, James L., Pawtucket, R. I.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Copper Wire Drawing and Rolling
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

MACHINERY—Covering Wire
Fidelity Machine Co., Philadelphia, Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Cutting
Broden Construction Co., Cleveland, O.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, O.
Moslo Machinery, Inc., Cleveland, O.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Die Making
Firth-Sterling Steel Co., McKeesport, Pa.

MACHINERY—Draw Benches
Standard Machinery Co., Providence, R. I.

MACHINERY—Edging
Standard Machinery Co., Providence, R. I.

MACHINERY—Enameling
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Extruding
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.
Royle, John & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

WHERE TO BUY, Continued

MACHINERY—Forming
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Galvanizing
Lee Wilson Engineering Co., Cleveland, Ohio

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Lee Wilson Engineering Co., Cleveland, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Grinding, Roll
Farrel-Birmingham Co., Inc., Ansonia, Conn.

MACHINERY—Insulating
American Insulating Mach'y. Co., Phila., Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Lead Encasing
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John, Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MACHINERY — Measuring Wire & Cable
Davis, R. L., Electric Co., Wallingford, Conn.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works Co., Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Paper Covering Wire
Terkelsen Machine Co., Boston, Mass.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine, Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Royle, John & Sons, Paterson, N. J.

MACHINERY—Rubber Strip Covering
Farrel-Birmingham Co., Inc., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
Farrel-Birmingham Co., Inc., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y. Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, O.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, O.
Moslo Machinery, Inc., Cleveland, O.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Swaging
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing
Entwistle, James L., Pawtucket, R. I.
Scott, Henry L., Co., Providence, R. I.

MACHINERY—Testing Size of Wire
Davis, R. L., Electric Co., Wallingford, Conn.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Testing—Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Welding Wire
Eisler Engineering Co., Inc., Newark, N. J.
Micro Products Co., Chicago, Ill.
Shuster, F. B., Co., New Haven, Conn.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.

MACHINERY—Winding
American Insulating Mach'y. Co., Phila., Pa.
Entwistle, James L., Pawtucket, R. I.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Insulating Mach'y. Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

MACHINERY—Wire Measuring
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Wood Screw
National Machinery Exchange (Used), New York, N. Y.

MACHINERY—Wrapping Wire
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MILLS—Rod, Bar, etc.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

MILLS—Strip, Hot and Cold For Iron, Steel, Copper, Brass, etc.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., The, Torrington, Conn.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Industrial
Carl-Mayer Corp., Cleveland, Ohio.
Ross Engineering Corp., J. O., New York, N. Y.

WHERE TO BUY, Continued

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Inc., Newark, N. J.

PAPER TESTERS—
Scott, Henry L., Co., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

PLASTIC TESTERS—
Scott, Henry L., Co., Providence, R. I.

POTS—Lead Melting
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.

PRESSES—Hydraulic and Mechanical
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

PRESSES—Lead
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

RECORDERS—Fault and Reel
Entwistle, James L., Pawtucket, R. I.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Moslo Machinery, Inc., Cleveland, O.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, O.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Constant Tension
Farrel-Birmingham Co., Inc., Ansonia, Conn.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, O.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Vulcanizing and Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, O.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Moslo Machinery, Inc., Cleveland, O.
Ross, J. O., Engineering Corp., New York, N. Y.

RODS—Wire—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.

ROLLS—Iron, Steel, Alloy
Farrel-Birmingham Co., Inc., Ansonia, Conn.

ROLLS—For Strip, Rod, Bar Mills
Farrel-Birmingham Co., Inc., Ansonia, Conn.

ROLL STRAIGHTENERS—
Moslo Machinery, Inc., Cleveland, O.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott, Henry L., Co., Providence, R. I.

RUST PROOF COMPOUND—
American Lanolin Co., Lawrence, Mass.

SHEET—Steel
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

SKIN PROTECTOR—
Magnus Chemical Co., Garwood, N. J.

SOAPS—Industrial and Wire Drawing
Magnus Chemical Co., Garwood, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

SOLDER—Alloys and Fluxes
Kester Solder Co., Chicago, Ill.

SPARK TESTING EQUIPMENT—
Entwistle, James L., Pawtucket, R. I.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Chicago, Ill.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

STAMPINGS—Steel
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Brass and Non Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.

STRIP METAL TESTERS—
Scott, Henry L., Co., Providence, R. I.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TAKE-UPS FOR CABLE, HOSE, LEAD PRESSES AND SHEET RUBBER—
Entwistle, James L., Pawtucket, R. I.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.

TENSILE TESTERS—
Scott, Henry L., Co., Providence, R. I.

TESTING INSTRUMENTS—
Entwistle, James L., Providence, R. I.
Scott, Henry L., Co., Providence, R. I.

TRAMRAIL SYSTEMS—
Cleveland Tramrail div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS—
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS—
Ruesch, H. J., Machine Co., Newark, N. J.

TURKS HEAD—Friction and Power Driven
Standard Machinery Co., Providence, R. I.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y. Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, O.

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.

WIRE—Enameled For Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Nickel Silver and Phosphor Bronze
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.

WIRE—Non Ferrous to Specification For Special Purposes
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Stainless Steel—
Callite Tungsten Corp., Union City, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE TESTERS—
Scott, Henry L., Co., Providence, R. I.

WIRE, WEAVING—Non Ferrous
Hudson Wire Co., Ossining, N. Y.

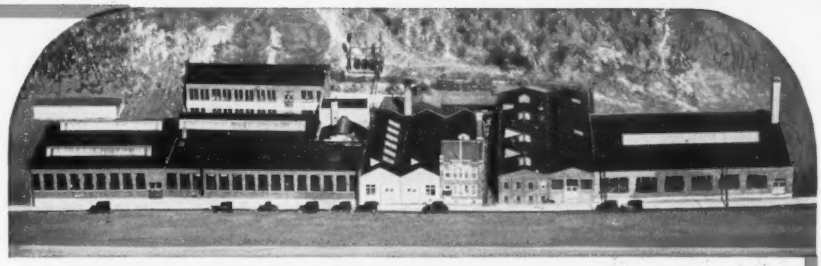
WRAPPING PAPER—Creped
Crepe-Kraft Co., Inc., Newark, N. J.

YARN TESTERS—
Scott, Henry L., Co., Providence, R. I.

HUDCO

SPECIALIZES

WINCO



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HUDCO AT OSSINING PRODUCES FINE WIRES IN ALL METALS.

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High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper.

Cadmium, Nickel Silver, 10%, 18%, and 30%; Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification, Metallic Fibre for Packing Purposes, Copper, Bronze, Zinc, Lead and Aluminum.

WIRES FOR METAL SPRAYING

Pure Lead, Lead Alloy, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire, High Conductivity, Electric Wire.

Cadmium, Nickel Silver, (10%, 18%, 30%); Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel, Commercial Bronze.

"HUDCO" SPECIALLY PROCESSED COPPER WIRE FOR ENAMELLING PURPOSES IS DRAWN FROM SELECTED COPPER, INSURING THE MAXIMUM CONDUCTIVITY. THIS SELECTION PLUS OUR LONG EXPERIENCE AND UNEXCELLED PLANT FACILITIES INSURE OUR CUSTOMER BETTER WIRE AT LOWER COST.

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ESTAB. 1902 SUCCESSORS - ROYLE AND AKIN

WINCO AT WINSTED, CONN. PRODUCES LEAKPROOF ENAMELLED WIRE AND OTHER WINCO ENAMELLED AND COVERED WIRES.

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HUDSON WIRE COMPANY
WINSTED CONNECTICUT

For Heat Treating Your Products Uniformly---Economically---Automatically

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The Chain Belt Conveyor Furnace is only one of the numerous types we build for various heat treating purposes. We build Gas Fired, Oil Fired and Electric Furnaces — Furnaces for any process, product or production. We solicit your inquiries.

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